

In the Claims

1-94 (canceled).

95 (original). A method of treating a mammal having diabetes comprising the administration to said mammal a pharmaceutically effective amount of an insulin sensitizer agent and a pharmaceutically effective amount of an FBPase inhibitor or prodrug or salt thereof.

96 (original). The method of claim 95 wherein said insulin sensitizer is a thiazolidinedione.

97 (original). The method of claim 96 wherein said thiazolidinedione is selected from the group consisting of BRL 49653, troglitazone, pioglitazone, ciglitazone, WAY-120,744, englitazone, AD 5075, GI-262570, SB219994, SB219993, and darglitazone.

98 (original). The method of claim 95 wherein said insulin sensitizer is a PPAR  $\gamma$  agonist.

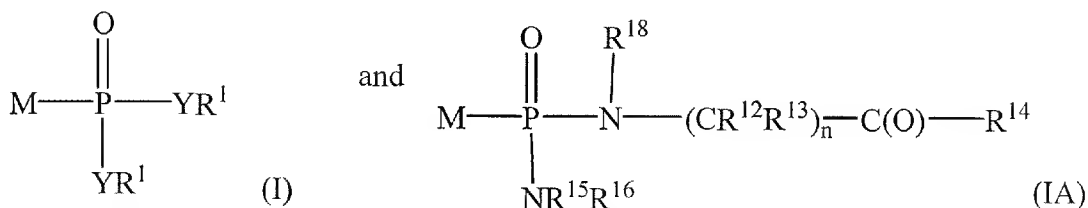
99 (original). The method of claim 98 wherein said PPAR  $\gamma$  agonist is selected from the group consisting of BRL 49653, troglitazone, pioglitazone, ciglitazone, WAY-120,744, englitazone, AD 5075, darglitazone, GI-262570, SB217092, SB 236636, SB 217092, SB 219994, and SB 219993.

100 (original). The method of claim 95 wherein said insulin sensitizer is a RXR ligand.

101 (original). The method of claim 100 wherein said RXR ligand is selected from the group consisting of 9-cis-retinoic acid, LG 100268 and LG 1069.

102 (original). The method of claim 95 wherein said insulin sensitizer is selected from the group consisting of an angiotensin converting enzyme inhibitor, a renin inhibitor, and an angiotensin antagonist.

103 (previously presented). The method of claim 95 wherein said FBPase inhibitor is a compound selected from the group consisting of formulae I and IA:



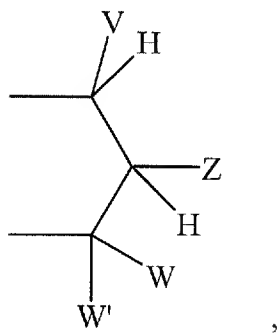
wherein *in vivo* or *in vitro* compounds of formulae I and IA are converted to  $\text{M-PO}_3^{2-}$  which inhibits FBPase and wherein

Y is independently selected from the group consisting of -O-, and -NR<sup>6</sup>-;

when Y is -O-, then R<sup>1</sup> attached to -O- is independently selected from the group consisting of -H, alkyl, optionally substituted aryl, optionally substituted alicyclic where the cyclic moiety contains a carbonate or thiocarbonate, optionally substituted -alkylaryl, -C(R<sup>2</sup>)<sub>2</sub>OC(O)NR<sup>2</sup><sub>2</sub>, -NR<sup>2</sup>-C(O)-R<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>-OC(O)R<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>-O-C(O)OR<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>OC(O)SR<sup>3</sup>, -alkyl-S-C(O)R<sup>3</sup>, -alkyl-S-S-alkylhydroxy, and -alkyl-S-S-S-alkylhydroxy,

when Y is -NR<sup>6</sup>-, then R<sup>1</sup> attached to -NR<sup>6</sup>- is independently selected from the group consisting of -H, -[C(R<sup>2</sup>)<sub>2</sub>]<sub>q</sub>-COOR<sup>3</sup>, -C(R<sup>4</sup>)<sub>2</sub>COOR<sup>3</sup>, -[C(R<sup>2</sup>)<sub>2</sub>]<sub>q</sub>-C(O)SR, and -cycloalkylene-COOR<sup>3</sup>;

or when either Y is independently selected from -O- and -NR<sup>6</sup>-, then together R<sup>1</sup> and R<sup>1</sup> are -alkyl-S-S-alkyl- to form a cyclic group, or together R<sup>1</sup> and R<sup>1</sup> are



wherein:

V, W, and W' are independently selected from the group consisting of -H, alkyl, aralkyl, alicyclic, aryl, substituted aryl, heteroaryl, substituted heteroaryl, 1-alkenyl, and 1-alkynyl; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group containing 5-7 atoms, optionally 1 heteroatom, substituted with hydroxy, acyloxy, alkoxycarbonyloxy, or aryloxycarbonyloxy attached to a carbon atom that is three atoms from both Y groups attached to the phosphorus; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group, optionally containing 1 heteroatom, that is fused to an aryl group at the beta and gamma position to the Y attached to the phosphorus;

together V and W are connected via an additional 3 carbon atoms to form an optionally substituted cyclic group containing 6 carbon atoms and substituted with one substituent selected from the group consisting of hydroxy, acyloxy, alkoxycarbonyloxy, alkylthiocarbonyloxy, and aryloxycarbonyloxy, attached to one of said carbon atoms that is three atoms from a Y attached to the phosphorus;

together Z and W are connected via an additional 3-5 atoms to form a cyclic group, optionally containing one heteroatom, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

together W and W' are connected via an additional 2-5 atoms to form a cyclic group, optionally containing 0-2 heteroatoms, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

Z is selected from the group consisting of  $-\text{CHR}^2\text{OH}$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{OR}^3$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{SR}^3$ ,  $-\text{CHR}^2\text{OCO}_2\text{R}^3$ ,  $-\text{OR}^2$ ,  $-\text{SR}^2$ ,  $-\text{CHR}^2\text{N}_3$ ,  $-\text{CH}_2\text{aryl}$ ,  $-\text{CH}(\text{aryl})\text{OH}$ ,  $-\text{CH}(\text{CH}=\text{CR}^2)\text{OH}$ ,  $-\text{CH}(\text{C}\equiv\text{CR}^2)\text{OH}$ ,  $-\text{R}^2$ ,  $-\text{NR}^2_2$ ,  $-\text{OCOR}^3$ ,  $-\text{OCO}_2\text{R}^3$ ,  $-\text{SCOR}^3$ ,  $-\text{SCO}_2\text{R}^3$ ,  $-\text{NHCOR}^2$ ,  $-\text{NHCO}_2\text{R}^3$ ,  $-\text{CH}_2\text{NHaryl}$ ,  $-(\text{CH}_2)_p-\text{OR}^2$ , and  $-(\text{CH}_2)_p-\text{SR}^2$ ;

p is an integer 2 or 3;

q is an integer 1 or 2;

with the provisos that:

- a) V, Z, W, W' are not all -H; and
- b) when Z is  $-\text{R}^2$ , then at least one of V, W, and W' is not -H, alkyl, aralkyl, or alicyclic;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and -H;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $R^4$  is independently selected from the group consisting of -H, and alkyl, or together  $R^4$  and  $R^4$  form a cyclic alkyl group;

$R^6$  is selected from the group consisting of -H, lower alkyl, acyloxyalkyl, alkoxycarbonyloxyalkyl, and lower acyl;

$n$  is an integer from 1 to 3;

$R^{18}$  is independently selected from the group consisting of H, lower alkyl, aryl, aralkyl, or together with  $R^{12}$  is connected via 1-4 carbon atoms to form a cyclic group;

each  $R^{12}$  and  $R^{13}$  is independently selected from the group consisting of H, lower alkyl, lower aryl, lower aralkyl, all optionally substituted, or  $R^{12}$  and  $R^{13}$  together are connected via 2-6 carbon atoms to form a cyclic group;

each  $R^{14}$  is independently selected from the group consisting of  $-OR^{17}$ ,  $-N(R^{17})_2$ ,  $-NHR^{17}$ , and  $-SR^{17}$ ;

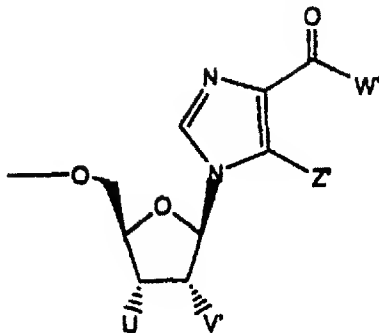
$R^{15}$  is selected from the group consisting of -H, lower alkyl, lower aryl, lower aralkyl, or together with  $R^{16}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

$R^{16}$  is selected from the group consisting of  $-(CR^{12}R^{13})_n-C(O)-R^{14}$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{15}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

each  $R^{17}$  is independently selected from the group consisting of lower alkyl, lower aryl, and lower aralkyl, or together  $R^{17}$  and  $R^{17}$  on N is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

with the proviso that when only one Y is -O-, and it is not part of a cyclic group containing the other Y, then the other Y must be  $-N(R^{18})-(CR^{12}R^{13})-C(O)-R^{14}$ .

104 (original). The method of claim 103 wherein said M is:



wherein

Z' is selected from the group consisting of alkyl or halogen,

U and V' are independently selected from the group consisting of hydrogen, hydroxy, acyloxy  
or when taken together form a lower cyclic ring containing at least one oxygen;

W' is selected from the group consisting of amino and lower alkyl amino;

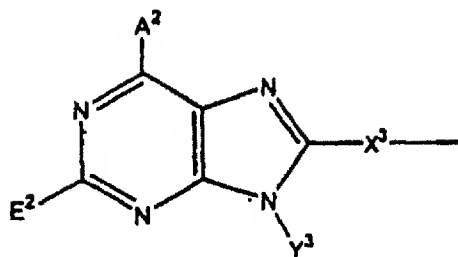
and pharmaceutically acceptable salts thereof.

105 (original). The method of claim 104 wherein said insulin sensitizer is a thiazolidinedione.

106 (original). The method of claim 104 wherein said insulin sensitizer is a PPAR  $\gamma$  agonist.

107 (original). The method of claim 104 wherein said insulin sensitizer is a RXR ligand.

108 (original). The method of claim 103 wherein M is:



wherein

$A^2$  is selected from the group consisting of  $-NR^8$ ,  $NHSO_2R^3$ ,  $-OR^5$ ,  $-SR^5$ , halogen, lower alkyl,  $-CON(R^4)_2$ , guanidine, amidine,  $-H$ , and perhaloalkyl;

$E^2$  is selected from the group consisting of  $-H$ , halogen, lower alkylthio, lower perhaloalkyl, lower alkyl, lower alkenyl, lower alkynyl, lower alkoxy,  $-CN$ , and  $-NR^7$ ;

$X^3$  is selected from the group consisting of  $-alkyl(hydroxy)-$ ,  $-alkyl-$ ,  $alkynyl-$ ,  $-aryl-$ ,  $-carbonylalkyl-$ ,  $-1,1-dihaloalkyl-$ ,  $-alkoxyalkyl-$ ,  $-alkyloxy-$ ,  $-alkylthioalkyl-$ ,  $-alkylthio-$ ,  $-alkylaminocarbonyl-$ ,  $-alkylcarbonylamino-$ ,  $-alicyclic-$ ,  $-aralkyl-$ ,  $-alkylaryl-$ ,  $-alkoxycarbonyl-$ ,  $-carbonyloxyalkyl-$ ,  $-alkoxycarbonylamino-$ , and  $-alkylaminocarbonylamino-$ , all optionally substituted; with the proviso that  $X^3$  is not substituted with  $-COOR^2$ ,  $-SO_3H$ , or  $-PO_3R^2$ ;

$Y^3$  is selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, aryloxyalkyl, alkoxyalkyl,  $-C(O)R^3$ ,  $-S(O)_2R^3$ ,  $-C(O)-R^{11}$ ,  $-CONHR^3$ ,  $-NR^2$ , and  $-OR^3$ , all except  $H$  are optionally substituted;

each  $R^4$  is independently selected from the group consisting of  $-H$  and alkyl, or together  $R^4$  and  $R^4$  form a cyclic alkyl group;

$R^5$  is selected from the group consisting of lower alkyl, lower aryl, lower aralkyl, and lower alicyclic;

$R^7$  is independently selected from the group consisting of  $-H$ , lower alkyl, lower alicyclic, lower aralkyl, lower aryl, and  $-C(O)R^{10}$ ;

$R^8$  is independently selected from the group consisting of  $-H$ , lower alkyl, lower aralkyl, lower aryl, lower alicyclic,  $-C(O)R^{10}$ , or together they form a bidendate alkyl;

$R^{10}$  is selected from the group consisting of  $-H$ , lower alkyl,  $-NH_2$ , lower aryl, and lower perhaloalkyl; and

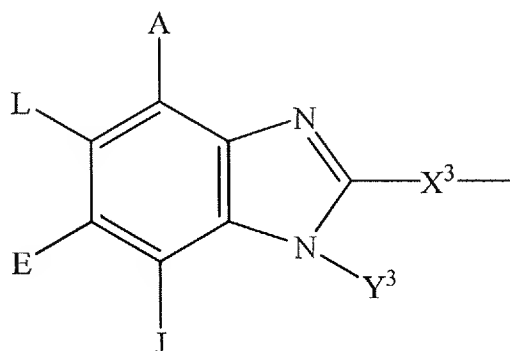
$R^{11}$  is selected from the group consisting of alkyl, aryl,  $-NR^2_2$ , and  $-OR^2$ , and pharmaceutically acceptable prodrugs and salts thereof.

109 (original). The method of claim 108 wherein said insulin sensitizer is a thiazolidinedione.

110 (original). The method of claim 108 wherein said insulin sensitizer is a PPAR  $\gamma$  agonist.

111 (original). The method of claim 108 wherein said insulin sensitizer is a RXR ligand.

112 (original). The method of claim 103 wherein M is:



wherein:

A, E, and L are selected from the group of  $-NR^8_2$ ,  $-NO_2$ ,  $-H$ ,  $-OR^7$ ,  $-SR^7$ ,  $-C(O)NR^4_2$ , halo,  $-COR^{11}$ ,  $-SO_2R^3$ , guanidine, amidine,  $-NHSO_2R^5$ ,  $-SO_2NR^4_2$ ,  $-CN$ , sulfoxide, perhaloacyl, perhaloalkyl, perhaloalkoxy, C1-C5 alkyl, C2-C5 alkenyl, C2-C5 alkynyl, and lower alicyclic, or together A and L form a cyclic group, or together L and E form a cyclic group, or together E and J form a cyclic group including aryl, cyclic alkyl, and heterocyclic;

J is selected from the group consisting of  $-NR^8_2$ ,  $-NO_2$ ,  $-H$ ,  $-OR^7$ ,  $-SR^7$ ,  $-C(O)NR^4_2$ , halo,  $-C(O)R^{11}$ ,  $-CN$ , sulfonyl, sulfoxide, perhaloalkyl, hydroxyalkyl, perhaloalkoxy, alkyl, haloalkyl, aminoalkyl, alkenyl, alkynyl, alicyclic, aryl, and aralkyl, or together with Y forms a cyclic group including aryl, cyclic alkyl, and heterocyclic alkyl;

$X^3$  is selected from the group consisting of  $-alkyl(hydroxy)-$ ,  $-alkyl-$ ,  $alkynyl-$ ,  $-aryl-$ ,  $-carbonylalkyl-$ ,  $-1,1-dihaloalkyl-$ ,  $-alkoxyalkyl-$ ,  $-alkyloxy-$ ,  $-alkylthioalkyl-$ ,  $-alkylthio-$ ,

-alkylaminocarbonyl-, -alkylcarbonylamino-, -alicyclic-, -aralkyl-, -alkylaryl-, -alkoxycarbonyl-, -carbonyloxyalkyl-, -alkoxycarbonylamino-, and -alkylaminocarbonylamino-, all optionally substituted; with the proviso that  $X^3$  is not substituted with  $-\text{COOR}^2$ ,  $-\text{SO}_3\text{H}$ , or  $-\text{PO}_3\text{R}^2$ ;

$Y^3$  is selected from the group consisting of  $-\text{H}$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, aryloxyalkyl, alkoxyalkyl,  $-\text{C}(\text{O})\text{R}^3$ ,  $-\text{S}(\text{O})_2\text{R}^3$ ,  $-\text{C}(\text{O})-\text{R}^{11}$ ,  $-\text{CONHR}^3$ ,  $-\text{NR}^2$ , and  $-\text{OR}^3$ , all except H are optionally substituted;

each  $\text{R}^4$  is independently selected from the group consisting of  $-\text{H}$  and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

$\text{R}^5$  is selected from the group consisting of lower alkyl, lower aryl, lower aralkyl, and lower alicyclic;

$\text{R}^7$  is independently selected from the group consisting of  $-\text{H}$ , lower alkyl, lower alicyclic, lower aralkyl, lower aryl, and  $-\text{C}(\text{O})\text{R}^{10}$ ;

$\text{R}^8$  is independently selected from the group consisting of  $-\text{H}$ , lower alkyl, lower aralkyl, lower aryl, lower alicyclic,  $-\text{C}(\text{O})\text{R}^{10}$ , or together they form a bidendate alkyl;

$\text{R}^{10}$  is selected from the group consisting of  $-\text{H}$ , lower alkyl,  $-\text{NH}_2$ , lower aryl, and lower perhaloalkyl;

$\text{R}^{11}$  is selected from the group consisting of alkyl, aryl,  $-\text{NR}^2$ , and  $-\text{OR}^2$ , and pharmaceutically acceptable prodrugs and salts thereof.

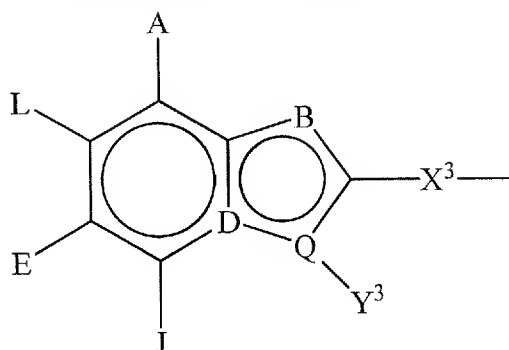
113 (original). The method of claim 112 wherein said insulin sensitizer is a thiazolidinedione.

114 (original). The method of claim 112 wherein said insulin sensitizer is a PPAR  $\gamma$  agonist.

115 (original). The method of claim 112 wherein said insulin sensitizer is a RXR ligand.



116 (original). The method of claim 103 wherein M is:



wherein

B is selected from the group consisting of  $-\text{NH}-$ ,  $-\text{N}=-$  and  $-\text{CH}=-$ ;

is selected from the group consisting of  $\text{C}=\text{N}$  and  $\text{N}=\text{C}$ ;

Q is selected from the group consisting of  $-\text{C}=-$  and  $-\text{N}-$  with the proviso that when B is  $-\text{NH}-$  then Q is  $-\text{C}=-$  and D is  $\text{C}=\text{N}$ , when B is  $-\text{CH}=-$  then Q is  $-\text{N}-$  and D is  $\text{C}=\text{N}$ , when B is  $-\text{N}=-$ , then D is  $\text{N}=\text{C}$  and Q is  $-\text{C}=-$ ;

A, E, and L are selected from the group of  $-\text{NR}^8_2$ ,  $-\text{NO}_2$ ,  $-\text{H}$ ,  $-\text{OR}^7$ ,  $-\text{SR}^7$ ,  $-\text{C(O)NR}^4_2$ , halo,  $-\text{COR}^{11}$ ,  $-\text{SO}_2\text{R}^3$ , guanidine, amidine,  $-\text{NHSO}_2\text{R}^5$ ,  $-\text{SO}_2\text{NR}^4_2$ ,  $-\text{CN}$ , sulfoxide, perhaloacyl, perhaloalkyl, perhaloalkoxy, C1-C5 alkyl, C2-C5 alkenyl, C2-C5 alkynyl, and lower alicyclic, or together A and L form a cyclic group, or together L and E form a cyclic group, or together E and J form a cyclic group including aryl, cyclic alkyl, and heterocyclic;

J is selected from the group consisting of  $-\text{NR}^8_2$ ,  $-\text{NO}_2$ ,  $-\text{H}$ ,  $-\text{OR}^7$ ,  $-\text{SR}^7$ ,  $-\text{C(O)NR}^4_2$ , halo,  $-\text{C(O)R}^{11}$ ,  $-\text{CN}$ , sulfonyl, sulfoxide, perhaloalkyl, hydroxyalkyl, perhaloalkoxy, alkyl, haloalkyl, aminoalkyl, alkenyl, alkynyl, alicyclic, aryl, and aralkyl, or together with Y forms a cyclic group including aryl, cyclic alkyl, and heterocyclic alkyl;

$\text{X}^3$  is selected from the group consisting of  $-\text{alkyl(hydroxy)}$ ,  $-\text{alkyl}$ ,  $-\text{alkynyl}$ ,  $-\text{aryl}$ ,  $-\text{carbonylalkyl}$ ,  $-\text{1,1-dihaloalkyl}$ ,  $-\text{alkoxyalkyl}$ ,  $-\text{alkyloxy}$ ,  $-\text{alkylthioalkyl}$ ,  $-\text{alkylthio}$ ,  $-\text{alkylaminocarbonyl}$ ,  $-\text{alkylcarbonylamino}$ ,  $-\text{alicyclic}$ ,  $-\text{aralkyl}$ ,  $-\text{alkylaryl}$ ,  $-\text{alkoxycarbonyl}$ ,  $-\text{carbonyloxyalkyl}$ ,  $-\text{alkoxycarbonylamino}$ , and  $-\text{alkylaminocarbonylamino}$ , all optionally substituted; with the proviso that  $\text{X}^3$  is not substituted with  $-\text{COOR}^2$ ,  $-\text{SO}_3\text{H}$ , or  $-\text{PO}_3\text{R}^2_2$ ;

$Y^3$  is selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, aryloxyalkyl, alkoxyalkyl,  $-C(O)R^3$ ,  $-S(O)_2R^3$ ,  $-C(O)-R^{11}$ ,  $-CONHR^3$ ,  $-NR^2_2$ , and  $-OR^3$ , all except H are optionally substituted;

each  $R^4$  is independently selected from the group consisting of  $-H$ , and alkyl, or together  $R^4$  and  $R^4$  form a cyclic alkyl group;

$R^5$  is selected from the group consisting of lower alkyl, lower aryl, lower aralkyl, and lower alicyclic;

$R^7$  is independently selected from the group consisting of  $-H$ , lower alkyl, lower alicyclic, lower aralkyl, lower aryl, and  $-C(O)R^{10}$ ;

$R^8$  is independently selected from the group consisting of  $-H$ , lower alkyl, lower aralkyl, lower aryl, lower alicyclic,  $-C(O)R^{10}$ , or together they form a bidendate alkyl;

$R^{10}$  is selected from the group consisting of  $-H$ , lower alkyl,  $-NH_2$ , lower aryl, and lower perhaloalkyl; and

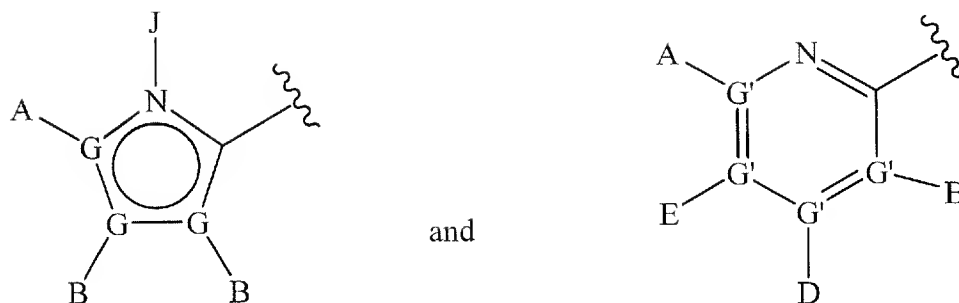
$R^{11}$  is selected from the group consisting of alkyl, aryl,  $-NR^2_2$ , and  $-OR^3$ , and pharmaceutically acceptable prodrugs and salts thereof.

117 (original). The method of claim 116 wherein said insulin sensitizer is a thiazolidinedione.

118 (original). The method of claim 116 wherein said insulin sensitizer is a PPAR  $\gamma$  agonist.

119 (original). The method of claim 116 wherein said insulin sensitizer is a RXR ligand.

120 (currently amended). The method of claim 103 wherein M is  $R^5-X$ - wherein  $R^5$  is selected from the group consisting of:



and

wherein:

each G is independently selected from the group consisting of C, N, O, S, and Se, and wherein only one G may be O, S, or Se, and at most one G is N;

each G' is independently selected from the group consisting of C and N and wherein no more than two G' groups are N;

A is selected from the group consisting of  $-H$ ,  $-NR^4_2$ ,  $-CONR^4_2$ ,  $-CO_2R^3$ , halo,  $-S(O)R^3$ ,  $-SO_2R^3$ , alkyl, alkenyl, alkynyl, perhaloalkyl, haloalkyl, aryl,  $-CH_2OH$ ,  $-CH_2NR^4_2$ ,  $-CH_2CN$ ,  $-CN$ ,  $-C(S)NH_2$ ,  $-OR^3$ ,  $-SR^3$ ,  $-N_3$ ,  $-NHC(S)NR^4_2$ ,  $-NHAc$ , and null;

each B and D are independently selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, alkoxyalkyl,  $-C(O)R^{11}$ ,  $-C(O)SR^3$ ,  $-SO_2R^{11}$ ,  $-S(O)R^3$ ,  $-CN$ ,  $-NR^9_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo,  $-NO_2$ , and null, all except  $-H$ ,  $-CN$ , perhaloalkyl,  $-NO_2$ , and halo are optionally substituted;

E is selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, alkoxyalkyl,  $-C(O)OR^3$ ,  $-CONR^4_2$ ,  $-CN$ ,  $-NR^9_2$ ,  $-NO_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo, and null, all except  $-H$ ,  $-CN$ , perhaloalkyl, and halo are optionally substituted;

J is selected from the group consisting of  $-H$  and null;

X is optionally substituted linking group that links  $R^5$  to the phosphorus atom via 2-4 atoms, including 0-1 heteroatoms selected from N, O, and S, except that if X is urea or carbamate there ~~is~~ are 2 heteroatoms, measured by the shortest path between  $R^5$  and the phosphorus atom, and wherein the atom attached to the phosphorus is a carbon atom,

and wherein X is selected from the group consisting of  $-alkyl(hydroxy)-$ ,  $-alkynyl-$ ,  $-heteroaryl-$ ,  $-carbonylalkyl-$ ,  $-1,1-dihaloalkyl-$ ,  $-alkoxyalkyl-$ ,  $alkyloxy-$ ,  $-alkylthioalkyl-$ ,

-alkylthio-, alkylaminocarbonyl-, alkylcarbonylamino-, -alkoxycarbonyl-, -carbonyloxyalkyl-, -alkoxycarbonylamino-, and -alkylaminocarbonylamino-, all optionally substituted; with the proviso that X is not substituted with  $-\text{COOR}^2$ ,  $-\text{SO}_3\text{H}$ , or  $-\text{PO}_3\text{R}^2_2$ ;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and  $-\text{H}$ ;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of  $-\text{H}$ , and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

each  $\text{R}^9$  is independently selected from the group consisting of  $-\text{H}$ , alkyl, aralkyl, and alicyclic, or together  $\text{R}^9$  and  $\text{R}^9$  form a cyclic alkyl group;

$\text{R}^{11}$  is selected from the group consisting of alkyl, aryl,  $-\text{NR}^2_2$ , and  $-\text{OR}^2$ ;

and with the proviso that:

- 1) when  $\text{G}'$  is N, then the respective A, B, D, or E is null;
- 2) at least one of A and B, or A, B, D, and E is not selected from the group consisting of  $-\text{H}$  or null;
- 3) when  $\text{R}^5$  is a six-membered ring, then X is not any 2 atom linker, an optionally substituted -alkyloxy-, or an optionally substituted -alkylthio-;
- 4) when G is N, then the respective A or B is not halogen or a group directly bonded to G via a heteroatom;
- 5) when X is not a -heteroaryl- group, then  $\text{R}^5$  is not substituted with two or more aryl groups;

and pharmaceutically acceptable prodrugs and salts thereof.

121 (original). The method of claim 120 wherein said insulin sensitizer is a thiazolidinedione.

122 (original). The method of claim 120 wherein said insulin sensitizer is a PPAR  $\gamma$  agonist.

123 (original). The method of claim 120 wherein said insulin sensitizer is a RXR ligand.

124 (original). The method of claim 95 wherein said combination is administered orally.

125 (original). The method of claim 98 wherein said combination is administered separately during the day.

126 (original). The method of claim 98 wherein said combination is administered simultaneously during the day.

127 (original). A method of treating a mammal having a disease characterized by insulin resistance and/or hyperglycemia comprising the administration to said mammal an effective amount of an insulin sensitizer agent and an FB Pase inhibiting amount of an FB Pase inhibitor.

128 (original). The method of claim 95 wherein said disease is characterized by insulin resistance.

129 (original). The method of claim 95 wherein said disease is characterized by hyperglycemia.

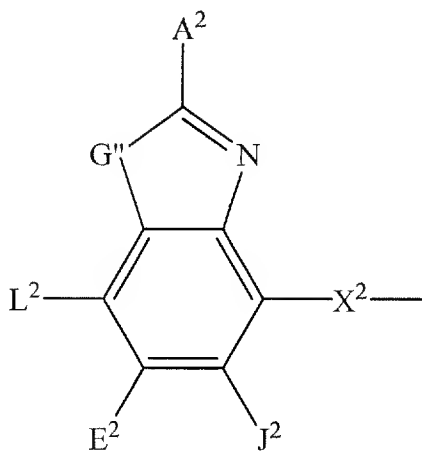
130 (original). The method of claim 95 wherein said disease is obesity.

131 (original). The method of claim 95 wherein said disease is hypertension.

132 (original). The method of claim 95 wherein said disease is polycystic ovarian syndrome.

133-137 (canceled).

138 (original). The method of claim 103 wherein M is:



wherein:

G'' is selected from the group consisting of -O- and -S-;

A<sup>2</sup>, L<sup>2</sup>, E<sup>2</sup> and J<sup>2</sup> are selected from the group consisting of -NR<sup>4</sup><sub>2</sub>, -NO<sub>2</sub>, -H, -OR<sup>2</sup>, -SR<sup>2</sup>, -C(O)NR<sup>4</sup><sub>2</sub>, halo, -COR<sup>11</sup>, -SO<sub>2</sub>R<sup>3</sup>, guanidiny, amidiny, aryl, aralkyl, alkyloxyalkyl, -SCN-, -NHSO<sub>2</sub>R<sup>9</sup>, -SO<sub>2</sub>NR<sup>4</sup><sub>2</sub>, -CN, -S(O)R<sup>3</sup>, perhaloacyl, perhaloalkyl, perhaloalkoxy, C1-C5 alkyl, C2-C5 alkenyl, C2-C5 alkynyl, and lower alicyclic, or together L<sup>2</sup> and E<sup>2</sup> or E<sup>2</sup> and J<sup>2</sup> form an annulated cyclic group;

X<sup>2</sup> is selected from the group consisting of -CR<sup>2</sup><sub>2</sub>-, -CF<sub>2</sub>-, -OCR<sup>2</sup><sub>2</sub>-, -SCR<sup>2</sup><sub>2</sub>-, -O-C(O)-, -S-C(O)-, -O-C(S)-, and -NR<sup>19</sup>CR<sup>2</sup><sub>2</sub>-, and wherein in the atom attached to the phosphorus is a carbon atom; with the proviso that X<sup>2</sup> is not substituted with -COOR<sup>2</sup>, -SO<sub>3</sub>H, or -PO<sub>3</sub>R<sup>2</sup><sub>2</sub>;

R<sup>2</sup> is selected from the group consisting of R<sup>3</sup> and -H;

R<sup>3</sup> is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each R<sup>4</sup> is independently selected from the group consisting of -H, and alkyl, or together R<sup>4</sup> and R<sup>4</sup> form a cyclic alkyl group;

each R<sup>9</sup> is independently selected from the group consisting of -H, alkyl, aralkyl, and alicyclic, or together R<sup>9</sup> and R<sup>9</sup> form a cyclic alkyl group;

R<sup>11</sup> is selected from the group consisting of alkyl, aryl, -NR<sup>2</sup><sub>2</sub>, and -OR<sup>2</sup>;

R<sup>19</sup> is selected from the group consisting of lower alkyl, -H, and -COR<sup>2</sup>; and  
pharmaceutically acceptable prodrugs and salts thereof.

139 (original). The method of claim 138 wherein said insulin sensitizer is a thiazolidinedione.

140 (original). The method of claim 138 wherein said insulin sensitizer is a PPAR  $\gamma$  agonist.

141 (original). The method of claim 138 wherein said insulin sensitizer is a RXR ligand.

142 (previously presented). A method of preventing diabetes in animals comprising administering to animals at risk of developing diabetes a pharmaceutically effective amount of an insulin sensitizer agent and a pharmaceutically effective amount of an FBPase inhibitor or prodrugs or salts thereof.

143 (previously presented). A method of treating impaired glucose tolerance comprising administering to patients in need thereof a pharmaceutically effective amount of an insulin sensitizer agent and a pharmaceutically effective amount of an FBPase inhibitor or prodrugs or salts thereof.

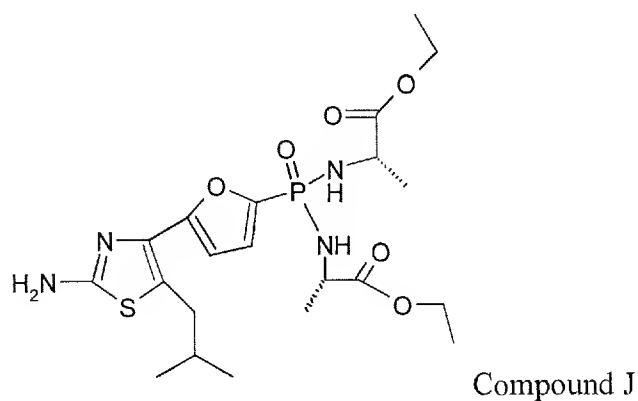
144 (previously presented). A method of treating insulin resistance comprising administering to patients in need thereof a pharmaceutically effective amount of an insulin sensitizer agent and a pharmaceutically effective amount of an FBPase inhibitor or prodrugs or salts thereof.

145 (previously presented). The method of claim 142 wherein said animals at risk of developing diabetes have a disease or condition selected from the group consisting of impaired glucose tolerance, insulin resistance, hyperglycemia, obesity, accelerated gluconeogenesis, and increased hepatic glucose output.

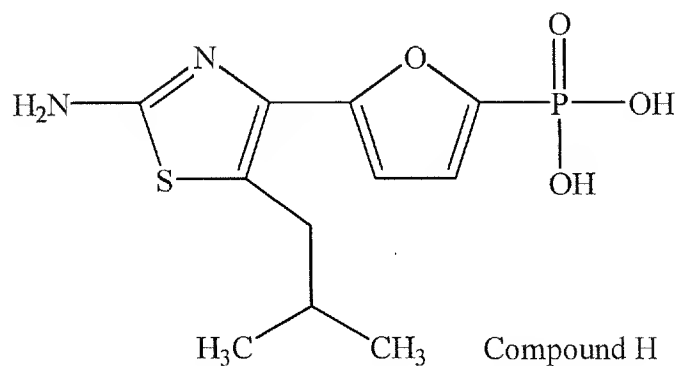
146 (previously presented). A method of treating or preventing a disease or condition selected from the group consisting of hyperlipidemia, atherosclerosis, ischemic injury, hypertension, and hypercholesterolemia which comprises administering to an animal in need thereof

a pharmaceutically effective amount of an insulin sensitizer agent and a pharmaceutically effective amount of an FBPase inhibitor or prodrugs or salts thereof.

147 (new). The method of claim 95 wherein said FBPase inhibitor is

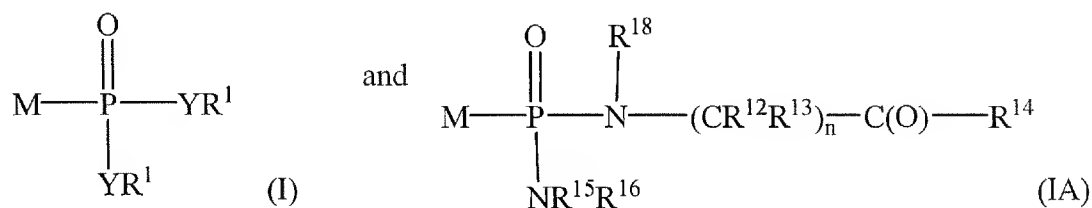


or



and said insulin sensitizer is troglitazone.

148 (new). The method of claim 127 wherein said FBPase inhibitor is a compound selected from the group consisting of formulae I and IA:





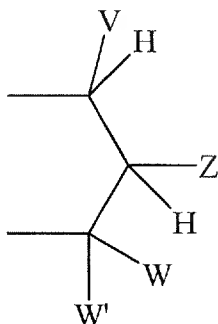
wherein *in vivo* or *in vitro* compounds of formulae I and IA are converted to  $M-PO_3^{2-}$  which inhibits FBPase and wherein

Y is independently selected from the group consisting of -O-, and -NR<sup>6</sup>-;

when Y is -O-, then R<sup>1</sup> attached to -O- is independently selected from the group consisting of -H, alkyl, optionally substituted aryl, optionally substituted alicyclic where the cyclic moiety contains a carbonate or thiocarbonate, optionally substituted -alkylaryl, -C(R<sup>2</sup>)<sub>2</sub>OC(O)NR<sup>2</sup>, -NR<sup>2</sup>-C(O)-R<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>-OC(O)R<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>-O-C(O)OR<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>OC(O)SR<sup>3</sup>, -alkyl-S-C(O)R<sup>3</sup>, -alkyl-S-S-alkylhydroxy, and -alkyl-S-S-S-alkylhydroxy,

when Y is -NR<sup>6</sup>-, then R<sup>1</sup> attached to -NR<sup>6</sup>- is independently selected from the group consisting of -H, -[C(R<sup>2</sup>)<sub>2</sub>]<sub>q</sub>-COOR<sup>3</sup>, -C(R<sup>4</sup>)<sub>2</sub>COOR<sup>3</sup>, -[C(R<sup>2</sup>)<sub>2</sub>]<sub>q</sub>-C(O)SR, and -cycloalkylene-COOR<sup>3</sup>;

or when either Y is independently selected from -O- and -NR<sup>6</sup>-, then together R<sup>1</sup> and R<sup>1</sup> are -alkyl-S-S-alkyl- to form a cyclic group, or together R<sup>1</sup> and R<sup>1</sup> are



wherein:

V, W, and W' are independently selected from the group consisting of -H, alkyl, aralkyl, alicyclic, aryl, substituted aryl, heteroaryl, substituted heteroaryl, 1-alkenyl, and 1-alkynyl; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group containing 5-7 atoms, optionally 1 heteroatom, substituted with hydroxy, acyloxy, alkoxycarbonyloxy, or aryloxycarbonyloxy attached to a carbon atom that is three atoms from both Y groups attached to the phosphorus; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group, optionally

containing 1 heteroatom, that is fused to an aryl group at the beta and gamma position to the Y attached to the phosphorus;

together V and W are connected via an additional 3 carbon atoms to form an optionally substituted cyclic group containing 6 carbon atoms and substituted with one substituent selected from the group consisting of hydroxy, acyloxy, alkoxycarbonyloxy, alkylthiocarbonyloxy, and aryloxycarbonyloxy, attached to one of said carbon atoms that is three atoms from a Y attached to the phosphorus;

together Z and W are connected via an additional 3-5 atoms to form a cyclic group, optionally containing one heteroatom, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

together W and W' are connected via an additional 2-5 atoms to form a cyclic group, optionally containing 0-2 heteroatoms, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

Z is selected from the group consisting of  $-\text{CHR}^2\text{OH}$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{OR}^3$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{SR}^3$ ,  $-\text{CHR}^2\text{OCO}_2\text{R}^3$ ,  $-\text{OR}^2$ ,  $-\text{SR}^2$ ,  $-\text{CHR}^2\text{N}_3$ ,  $-\text{CH}_2\text{aryl}$ ,  $-\text{CH}(\text{aryl})\text{OH}$ ,  $-\text{CH}(\text{CH}=\text{CR}^2_2)\text{OH}$ ,  $-\text{CH}(\text{C}\equiv\text{CR}^2_2)\text{OH}$ ,  $-\text{R}^2$ ,  $-\text{NR}^2_2$ ,  $-\text{OCOR}^3$ ,  $-\text{OCO}_2\text{R}^3$ ,  $-\text{SCOR}^3$ ,  $-\text{SCO}_2\text{R}^3$ ,  $-\text{NHCOR}^2$ ,  $-\text{NHCO}_2\text{R}^3$ ,  $-\text{CH}_2\text{NHaryl}$ ,  $-(\text{CH}_2)_p-\text{OR}^2$ , and  $-(\text{CH}_2)_p-\text{SR}^2$ ;

p is an integer 2 or 3;

q is an integer 1 or 2;

with the provisos that:

- a) V, Z, W, W' are not all -H; and
- b) when Z is  $-\text{R}^2$ , then at least one of V, W, and W' is not -H, alkyl, aralkyl, or alicyclic;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and -H;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of -H, and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

$\text{R}^6$  is selected from the group consisting of -H, lower alkyl, acyloxyalkyl, alkoxycarbonyloxyalkyl, and lower acyl;

n is an integer from 1 to 3;

$R^{18}$  is independently selected from the group consisting of H, lower alkyl, aryl, aralkyl, or together with  $R^{12}$  is connected via 1-4 carbon atoms to form a cyclic group;

each  $R^{12}$  and  $R^{13}$  is independently selected from the group consisting of H, lower alkyl, lower aryl, lower aralkyl, all optionally substituted, or  $R^{12}$  and  $R^{13}$  together are connected via 2-6 carbon atoms to form a cyclic group;

each  $R^{14}$  is independently selected from the group consisting of  $-OR^{17}$ ,  $-N(R^{17})_2$ ,  $-NHR^{17}$ , and  $-SR^{17}$ ;

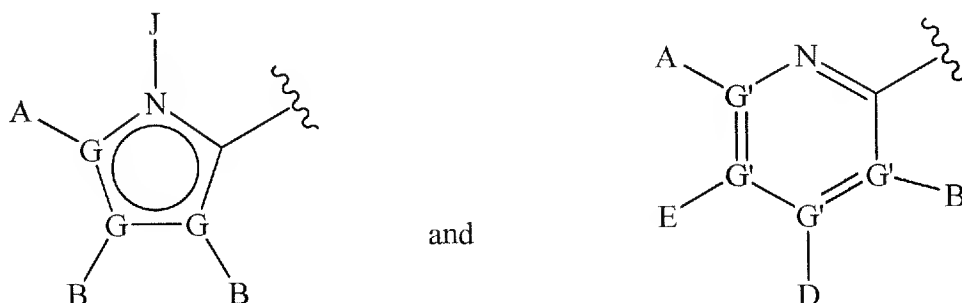
$R^{15}$  is selected from the group consisting of  $-H$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{16}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

$R^{16}$  is selected from the group consisting of  $-(CR^{12}R^{13})_n-C(O)-R^{14}$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{15}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

each  $R^{17}$  is independently selected from the group consisting of lower alkyl, lower aryl, and lower aralkyl, or together  $R^{17}$  and  $R^{17}$  on N is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

with the proviso that when only one Y is  $-O-$ , and it is not part of a cyclic group containing the other Y, then the other Y must be  $-N(R^{18})-(CR^{12}R^{13})-C(O)-R^{14}$ .

149 (new). The method of claim 148 wherein M is  $R^5$ -X- wherein  $R^5$  is selected from the group consisting of:



wherein:

each G is independently selected from the group consisting of C, N, O, S, and Se, and wherein only one G may be O, S, or Se, and at most one G is N;

each G' is independently selected from the group consisting of C and N and wherein no more than two G' groups are N;

A is selected from the group consisting of -H,  $-NR^4_2$ ,  $-CONR^4_2$ ,  $-CO_2R^3$ , halo,  $-S(O)R^3$ ,  $-SO_2R^3$ , alkyl, alkenyl, alkynyl, perhaloalkyl, haloalkyl, aryl,  $-CH_2OH$ ,  $-CH_2NR^4_2$ ,  $-CH_2CN$ ,  $-CN$ ,  $-C(S)NH_2$ ,  $-OR^3$ ,  $-SR^3$ ,  $-N_3$ ,  $-NHC(S)NR^4_2$ ,  $-NHAc$ , and null;

each B and D are independently selected from the group consisting of -H, alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, alkoxyalkyl,  $-C(O)R^{11}$ ,  $-C(O)SR^3$ ,  $-SO_2R^{11}$ ,  $-S(O)R^3$ ,  $-CN$ ,  $-NR^9_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo,  $-NO_2$ , and null, all except -H,  $-CN$ , perhaloalkyl,  $-NO_2$ , and halo are optionally substituted;

E is selected from the group consisting of -H, alkyl, alkenyl, alkynyl, aryl, alicyclic, alkoxyalkyl,  $-C(O)OR^3$ ,  $-CONR^4_2$ ,  $-CN$ ,  $-NR^9_2$ ,  $-NO_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo, and null, all except -H,  $-CN$ , perhaloalkyl, and halo are optionally substituted;

J is selected from the group consisting of -H and null;

X is optionally substituted linking group that links  $R^5$  to the phosphorus atom via 2-4 atoms, including 0-1 heteroatoms selected from N, O, and S, except that if X is urea or carbamate there are 2 heteroatoms, measured by the shortest path between  $R^5$  and the phosphorus atom, and wherein the atom attached to the phosphorus is a carbon atom,

and wherein X is selected from the group consisting of -alkyl(hydroxy)-, -alkynyl-, -heteroaryl-, -carbonylalkyl-, -1,1-dihaloalkyl-, -alkoxyalkyl-, alkyloxy-, -alkylthioalkyl-, -alkylthio-, alkylaminocarbonyl-, alkylcarbonylamino-, -alkoxycarbonyl-, -carbonyloxyalkyl-, -alkoxycarbonylamino-, and -alkylaminocarbonylamino-, all optionally substituted; with the proviso that X is not substituted with  $-\text{COOR}^2$ ,  $-\text{SO}_3\text{H}$ , or  $-\text{PO}_3\text{R}^2$ ;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and  $-\text{H}$ ;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of  $-\text{H}$ , and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

each  $\text{R}^9$  is independently selected from the group consisting of  $-\text{H}$ , alkyl, aralkyl, and alicyclic, or together  $\text{R}^9$  and  $\text{R}^9$  form a cyclic alkyl group;

$\text{R}^{11}$  is selected from the group consisting of alkyl, aryl,  $-\text{NR}^2_2$ , and  $-\text{OR}^2$ ;

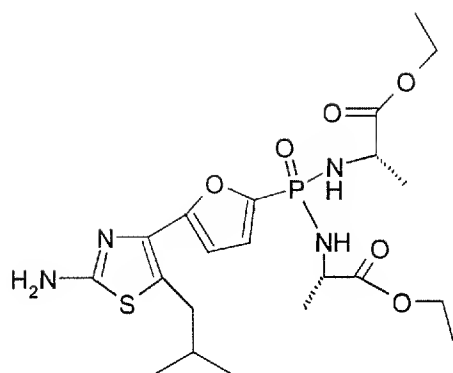
and with the proviso that:

- 1) when  $\text{G}'$  is N, then the respective A, B, D, or E is null;
- 2) at least one of A and B, or A, B, D, and E is not selected from the group consisting of  $-\text{H}$  or null;
- 3) when  $\text{R}^5$  is a six-membered ring, then X is not any 2 atom linker, an optionally substituted -alkyloxy-, or an optionally substituted -alkylthio-;
- 4) when G is N, then the respective A or B is not halogen or a group directly bonded to G via a heteroatom;
- 5) when X is not a -heteroaryl- group, then  $\text{R}^5$  is not substituted with two or more aryl groups;

and pharmaceutically acceptable prodrugs and salts thereof.

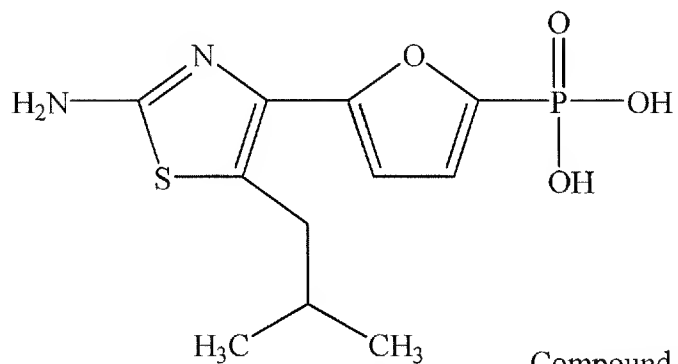
150 (new). The method of claim 147 wherein said insulin sensitizer is a thiazolidinedione.

151 (new). The method of claim 127 wherein said FBPase inhibitor is



Compound J

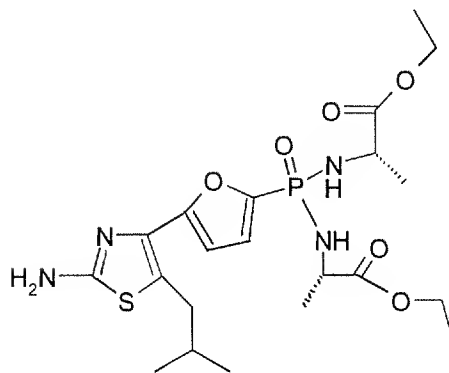
or



Compound H

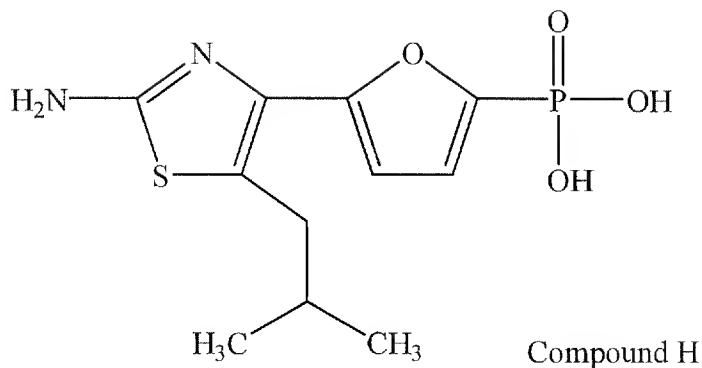
and said insulin sensitizer is troglitazone.

152 (new). The method of claim 142 wherein said FBPase inhibitor is



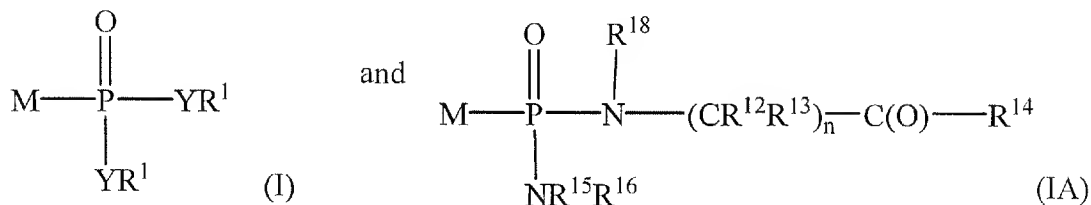
Compound J

or



and said insulin sensitizer is troglitazone.

153 (new). The method of claim 142 wherein said FBPase inhibitor is a compound selected from the group consisting of formulae I and IA:



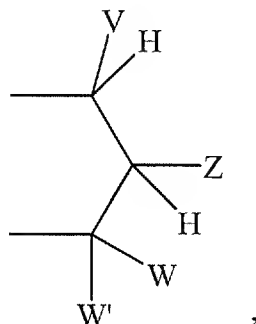
wherein *in vivo* or *in vitro* compounds of formulae I and IA are converted to  $\text{M-PO}_3^{2-}$  which inhibits FBPase and wherein

Y is independently selected from the group consisting of -O-, and  $-\text{NR}^6$ ;

when Y is -O-, then  $\text{R}^1$  attached to -O- is independently selected from the group consisting of -H, alkyl, optionally substituted aryl, optionally substituted alicyclic where the cyclic moiety contains a carbonate or thiocarbonate, optionally substituted -alkylaryl,  $-\text{C}(\text{R}^2)_2\text{OC}(\text{O})\text{NR}^2_2$ ,  $-\text{NR}^2-\text{C}(\text{O})-\text{R}^3$ ,  $-\text{C}(\text{R}^2)_2-\text{OC}(\text{O})\text{R}^3$ ,  $-\text{C}(\text{R}^2)_2-\text{O}-\text{C}(\text{O})\text{OR}^3$ ,  $-\text{C}(\text{R}^2)_2\text{OC}(\text{O})\text{SR}^3$ , -alkyl-S-C(O)R<sup>3</sup>, -alkyl-S-S-alkylhydroxy, and -alkyl-S-S-S-alkylhydroxy,

when Y is  $-\text{NR}^6$ -, then  $\text{R}^1$  attached to  $-\text{NR}^6$ - is independently selected from the group consisting of -H,  $-\text{[C}(\text{R}^2)_2\text{]}_q-\text{COOR}^3$ ,  $-\text{C}(\text{R}^4)_2\text{COOR}^3$ ,  $-\text{[C}(\text{R}^2)_2\text{]}_q-\text{C}(\text{O})\text{SR}$ , and -cycloalkylene-COOR<sup>3</sup>;

or when either Y is independently selected from -O- and -NR<sup>6</sup>-, then together R<sup>1</sup> and R<sup>1</sup> are -alkyl-S-S-alkyl- to form a cyclic group, or together R<sup>1</sup> and R<sup>1</sup> are



wherein:

V, W, and W' are independently selected from the group consisting of -H, alkyl, aralkyl, alicyclic, aryl, substituted aryl, heteroaryl, substituted heteroaryl, 1-alkenyl, and 1-alkynyl; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group containing 5-7 atoms, optionally 1 heteroatom, substituted with hydroxy, acyloxy, alkoxycarbonyloxy, or aryloxycarbonyloxy attached to a carbon atom that is three atoms from both Y groups attached to the phosphorus; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group, optionally containing 1 heteroatom, that is fused to an aryl group at the beta and gamma position to the Y attached to the phosphorus;

together V and W are connected via an additional 3 carbon atoms to form an optionally substituted cyclic group containing 6 carbon atoms and substituted with one substituent selected from the group consisting of hydroxy, acyloxy, alkoxycarbonyloxy, alkylthiocarbonyloxy, and aryloxycarbonyloxy, attached to one of said carbon atoms that is three atoms from a Y attached to the phosphorus;

together Z and W are connected via an additional 3-5 atoms to form a cyclic group, optionally containing one heteroatom, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

together W and W' are connected via an additional 2-5 atoms to form a cyclic group, optionally containing 0-2 heteroatoms, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;



Z is selected from the group consisting of  $-\text{CHR}^2\text{OH}$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{OR}^3$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{SR}^3$ ,  $-\text{CHR}^2\text{OCO}_2\text{R}^3$ ,  $-\text{OR}^2$ ,  $-\text{SR}^2$ ,  $-\text{CHR}^2\text{N}_3$ ,  $-\text{CH}_2\text{aryl}$ ,  $-\text{CH}(\text{aryl})\text{OH}$ ,  $-\text{CH}(\text{CH}=\text{CR}^2_2)\text{OH}$ ,  $-\text{CH}(\text{C}\equiv\text{CR}^2)\text{OH}$ ,  $-\text{R}^2$ ,  $-\text{NR}^2_2$ ,  $-\text{OCOR}^3$ ,  $-\text{OCO}_2\text{R}^3$ ,  $-\text{SCOR}^3$ ,  $-\text{SCO}_2\text{R}^3$ ,  $-\text{NHCOR}^2$ ,  $-\text{NHCO}_2\text{R}^3$ ,  $-\text{CH}_2\text{NHaryl}$ ,  $-(\text{CH}_2)_p-\text{OR}^2$ , and  $-(\text{CH}_2)_p-\text{SR}^2$ ;

p is an integer 2 or 3;

q is an integer 1 or 2;

with the provisos that:

- a) V, Z, W, W' are not all -H; and
- b) when Z is  $-\text{R}^2$ , then at least one of V, W, and W' is not -H, alkyl, aralkyl, or alicyclic;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and -H;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of -H, and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

$\text{R}^6$  is selected from the group consisting of -H, lower alkyl, acyloxyalkyl, alkoxycarbonyloxyalkyl, and lower acyl;

n is an integer from 1 to 3;

$\text{R}^{18}$  is independently selected from the group consisting of H, lower alkyl, aryl, aralkyl, or together with  $\text{R}^{12}$  is connected via 1-4 carbon atoms to form a cyclic group;

each  $\text{R}^{12}$  and  $\text{R}^{13}$  is independently selected from the group consisting of H, lower alkyl, lower aryl, lower aralkyl, all optionally substituted, or  $\text{R}^{12}$  and  $\text{R}^{13}$  together are connected via 2-6 carbon atoms to form a cyclic group;

each  $\text{R}^{14}$  is independently selected from the group consisting of  $-\text{OR}^{17}$ ,  $-\text{N}(\text{R}^{17})_2$ ,  $-\text{NHR}^{17}$ , and  $-\text{SR}^{17}$ ;

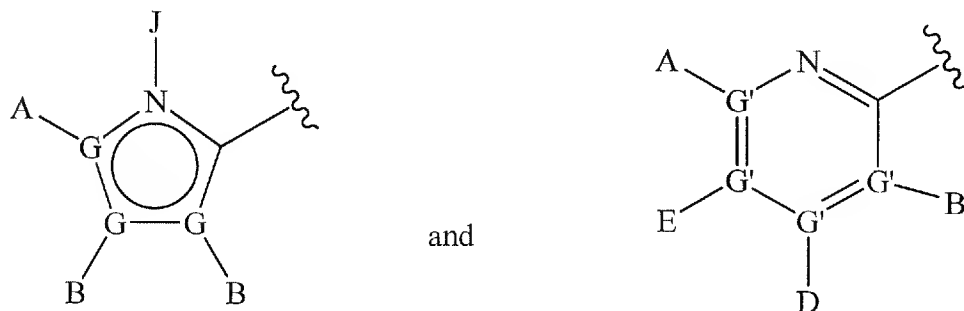
$\text{R}^{15}$  is selected from the group consisting of -H, lower alkyl, lower aryl, lower aralkyl, or together with  $\text{R}^{16}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

$R^{16}$  is selected from the group consisting of  $-(CR^{12}R^{13})_n-C(O)-R^{14}$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{15}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

each  $R^{17}$  is independently selected from the group consisting of lower alkyl, lower aryl, and lower aralkyl, or together  $R^{17}$  and  $R^{17}$  on N is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

with the proviso that when only one Y is  $-O-$ , and it is not part of a cyclic group containing the other Y, then the other Y must be  $-N(R^{18})-(CR^{12}R^{13})-C(O)-R^{14}$ .

154 (new). The method of claim 153 wherein M is  $R^5-X-$  wherein  $R^5$  is selected from the group consisting of:



wherein:

each G is independently selected from the group consisting of C, N, O, S, and Se, and wherein only one G may be O, S, or Se, and at most one G is N;

each G' is independently selected from the group consisting of C and N and wherein no more than two G' groups are N;

A is selected from the group consisting of  $-H$ ,  $-NR^4_2$ ,  $-CONR^4_2$ ,  $-CO_2R^3$ , halo,  $-S(O)R^3$ ,  $-SO_2R^3$ , alkyl, alkenyl, alkynyl, perhaloalkyl, haloalkyl, aryl,  $-CH_2OH$ ,  $-CH_2NR^4_2$ ,  $-CH_2CN$ ,  $-CN$ ,  $-C(S)NH_2$ ,  $-OR^3$ ,  $-SR^3$ ,  $-N_3$ ,  $-NHC(S)NR^4_2$ ,  $-NHAc$ , and null;

each B and D are independently selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, alkoxyalkyl,  $-C(O)R^{11}$ ,  $-C(O)SR^3$ ,  $-SO_2R^{11}$ ,  $-S(O)R^3$ ,  $-CN$ ,

$-\text{NR}^9_2$ ,  $-\text{OR}^3$ ,  $-\text{SR}^3$ , perhaloalkyl, halo,  $-\text{NO}_2$ , and null, all except  $-\text{H}$ ,  $-\text{CN}$ , perhaloalkyl,  $-\text{NO}_2$ , and halo are optionally substituted;

E is selected from the group consisting of  $-\text{H}$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, alkoxyalkyl,  $-\text{C}(\text{O})\text{OR}^3$ ,  $-\text{CONR}^4_2$ ,  $-\text{CN}$ ,  $-\text{NR}^9_2$ ,  $-\text{NO}_2$ ,  $-\text{OR}^3$ ,  $-\text{SR}^3$ , perhaloalkyl, halo, and null, all except  $-\text{H}$ ,  $-\text{CN}$ , perhaloalkyl, and halo are optionally substituted;

J is selected from the group consisting of  $-\text{H}$  and null;

X is optionally substituted linking group that links  $\text{R}^5$  to the phosphorus atom via 2-4 atoms, including 0-1 heteroatoms selected from N, O, and S, except that if X is urea or carbamate there are 2 heteroatoms, measured by the shortest path between  $\text{R}^5$  and the phosphorus atom, and wherein the atom attached to the phosphorus is a carbon atom,

and wherein X is selected from the group consisting of  $-\text{alkyl}(\text{hydroxy})-$ ,  $-\text{alkynyl}-$ ,  $-\text{heteroaryl}-$ ,  $-\text{carbonylalkyl}-$ ,  $-1,1\text{-dihaloalkyl}-$ ,  $-\text{alkoxyalkyl}-$ ,  $\text{alkyloxy}-$ ,  $-\text{alkylthioalkyl}-$ ,  $-\text{alkylthio}-$ ,  $\text{alkylaminocarbonyl}-$ ,  $\text{alkylcarbonylamino}-$ ,  $-\text{alkoxycarbonyl}-$ ,  $-\text{carbonyloxyalkyl}-$ ,  $-\text{alkoxycarbonylamino}-$ , and  $-\text{alkylaminocarbonylamino}-$ , all optionally substituted; with the proviso that X is not substituted with  $-\text{COOR}^2$ ,  $-\text{SO}_3\text{H}$ , or  $-\text{PO}_3\text{R}^2_2$ ;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and  $-\text{H}$ ;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of  $-\text{H}$ , and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

each  $\text{R}^9$  is independently selected from the group consisting of  $-\text{H}$ , alkyl, aralkyl, and alicyclic, or together  $\text{R}^9$  and  $\text{R}^9$  form a cyclic alkyl group;

$\text{R}^{11}$  is selected from the group consisting of alkyl, aryl,  $-\text{NR}^2_2$ , and  $-\text{OR}^2$ ;

and with the proviso that:

- 1) when  $\text{G}'$  is N, then the respective A, B, D, or E is null;
- 2) at least one of A and B, or A, B, D, and E is not selected from the group consisting of  $-\text{H}$  or null;
- 3) when  $\text{R}^5$  is a six-membered ring, then X is not any 2 atom linker, an optionally substituted  $-\text{alkyloxy}-$ , or an optionally substituted  $-\text{alkylthio}-$ ;
- 4) when G is N, then the respective A or B is not halogen or a group directly bonded to

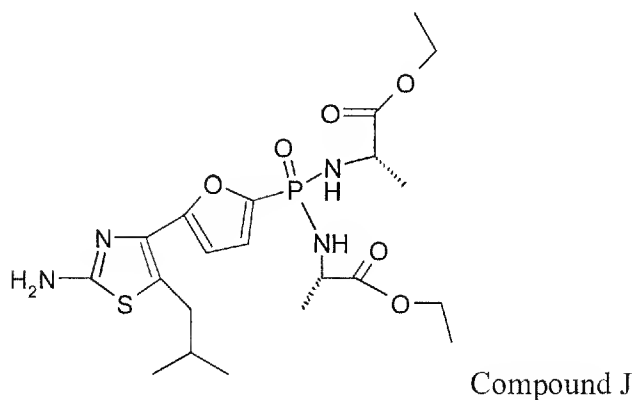
G via a heteroatom;

- 5) when X is not a -heteroaryl- group, then R<sup>5</sup> is not substituted with two or more aryl groups;

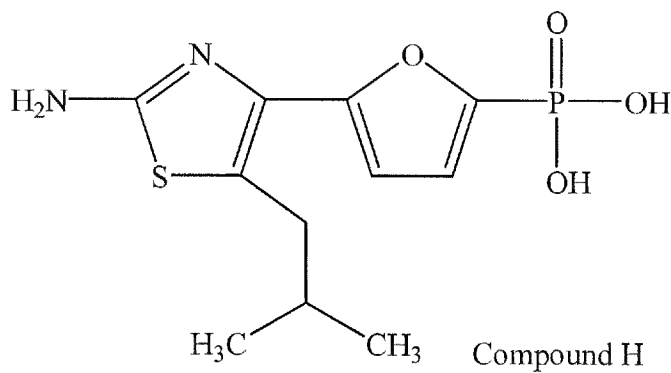
and pharmaceutically acceptable prodrugs and salts thereof.

155 (new). The method of claim 142 wherein said insulin sensitizer is a thiazolidinedione.

156 (new). The method of claim 143 wherein said FBPase inhibitor is

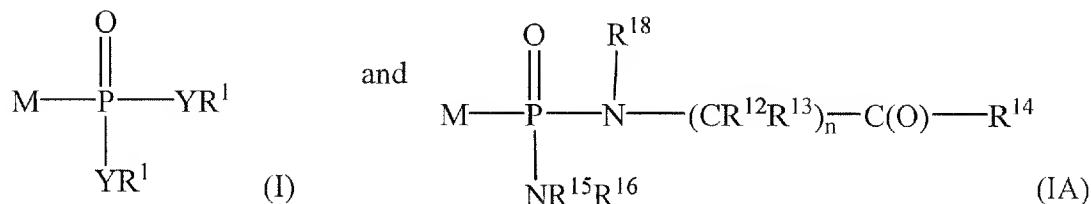


or



and said insulin sensitizer is troglitazone.

157 (new). The method of claim 143 wherein said FB Pase inhibitor is a compound selected from the group consisting of formulae I and IA:



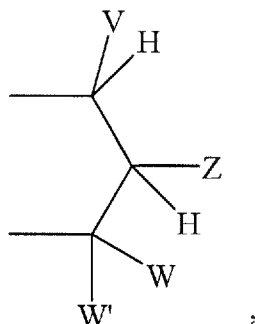
wherein *in vivo* or *in vitro* compounds of formulae I and IA are converted to  $\text{M-PO}_3^{2-}$  which inhibits FB Pase and wherein

Y is independently selected from the group consisting of -O-, and  $-\text{NR}^6-$ ;

when Y is -O-, then  $\text{R}^1$  attached to -O- is independently selected from the group consisting of -H, alkyl, optionally substituted aryl, optionally substituted alicyclic where the cyclic moiety contains a carbonate or thiocarbonate, optionally substituted -alkylaryl,  $-\text{C}(\text{R}^2)_2\text{OC}(\text{O})\text{NR}^2_2$ ,  $-\text{NR}^2-\text{C}(\text{O})-\text{R}^3$ ,  $-\text{C}(\text{R}^2)_2-\text{OC}(\text{O})\text{R}^3$ ,  $-\text{C}(\text{R}^2)_2-\text{O}-\text{C}(\text{O})\text{OR}^3$ ,  $-\text{C}(\text{R}^2)_2\text{OC}(\text{O})\text{SR}^3$ , -alkyl-S-C(O) $\text{R}^3$ , -alkyl-S-S-alkylhydroxy, and -alkyl-S-S-S-alkylhydroxy,

when Y is  $-\text{NR}^6-$ , then  $\text{R}^1$  attached to  $-\text{NR}^6-$  is independently selected from the group consisting of -H,  $-\text{[C}(\text{R}^2)_2\text{]}_q-\text{COOR}^3$ ,  $-\text{C}(\text{R}^4)_2\text{COOR}^3$ ,  $-\text{[C}(\text{R}^2)_2\text{]}_q-\text{C}(\text{O})\text{SR}$ , and -cycloalkylene-COOR<sup>3</sup>;

or when either Y is independently selected from -O- and  $-\text{NR}^6-$ , then together  $\text{R}^1$  and  $\text{R}^1$  are -alkyl-S-S-alkyl- to form a cyclic group, or together  $\text{R}^1$  and  $\text{R}^1$  are



wherein:

V, W, and W' are independently selected from the group consisting of -H, alkyl, aralkyl, alicyclic, aryl, substituted aryl, heteroaryl, substituted heteroaryl, 1-alkenyl, and 1-alkynyl; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group containing 5-7 atoms, optionally 1 heteroatom, substituted with hydroxy, acyloxy, alkoxy, alkoxy, alkoxy, alkoxy, or aryloxy, attached to a carbon atom that is three atoms from both Y groups attached to the phosphorus; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group, optionally containing 1 heteroatom, that is fused to an aryl group at the beta and gamma position to the Y attached to the phosphorus;

together V and W are connected via an additional 3 carbon atoms to form an optionally substituted cyclic group containing 6 carbon atoms and substituted with one substituent selected from the group consisting of hydroxy, acyloxy, alkoxy, alkoxy, alkoxy, alkoxy, and aryloxy, attached to one of said carbon atoms that is three atoms from a Y attached to the phosphorus;

together Z and W are connected via an additional 3-5 atoms to form a cyclic group, optionally containing one heteroatom, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

together W and W' are connected via an additional 2-5 atoms to form a cyclic group, optionally containing 0-2 heteroatoms, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

Z is selected from the group consisting of  $-\text{CHR}^2\text{OH}$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{OR}^3$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{SR}^3$ ,  $-\text{CHR}^2\text{OCO}_2\text{R}^3$ ,  $-\text{OR}^2$ ,  $-\text{SR}^2$ ,  $-\text{CHR}^2\text{N}_3$ ,  $-\text{CH}_2\text{aryl}$ ,  $-\text{CH}(\text{aryl})\text{OH}$ ,  $-\text{CH}(\text{CH}=\text{CR}^2_2)\text{OH}$ ,  $-\text{CH}(\text{C}\equiv\text{CR}^2_2)\text{OH}$ ,  $-\text{R}^2$ ,  $-\text{NR}^2_2$ ,  $-\text{OCOR}^3$ ,  $-\text{OCO}_2\text{R}^3$ ,  $-\text{SCOR}^3$ ,  $-\text{SCO}_2\text{R}^3$ ,  $-\text{NHCOR}^2$ ,  $-\text{NHCO}_2\text{R}^3$ ,  $-\text{CH}_2\text{NHaryl}$ ,  $-(\text{CH}_2)_p-\text{OR}^2$ , and  $-(\text{CH}_2)_p-\text{SR}^2$ ;

p is an integer 2 or 3;

q is an integer 1 or 2;

with the provisos that:

- a) V, Z, W, W' are not all -H; and
- b) when Z is  $-\text{R}^2$ , then at least one of V, W, and W' is not -H, alkyl, aralkyl, or alicyclic;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and -H;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $R^4$  is independently selected from the group consisting of -H, and alkyl, or together  $R^4$  and  $R^4$  form a cyclic alkyl group;

$R^6$  is selected from the group consisting of -H, lower alkyl, acyloxyalkyl, alkoxycarbonyloxyalkyl, and lower acyl;

n is an integer from 1 to 3;

$R^{18}$  is independently selected from the group consisting of H, lower alkyl, aryl, aralkyl, or together with  $R^{12}$  is connected via 1-4 carbon atoms to form a cyclic group;

each  $R^{12}$  and  $R^{13}$  is independently selected from the group consisting of H, lower alkyl, lower aryl, lower aralkyl, all optionally substituted, or  $R^{12}$  and  $R^{13}$  together are connected via 2-6 carbon atoms to form a cyclic group;

each  $R^{14}$  is independently selected from the group consisting of  $-OR^{17}$ ,  $-N(R^{17})_2$ ,  $-NHR^{17}$ , and  $-SR^{17}$ ;

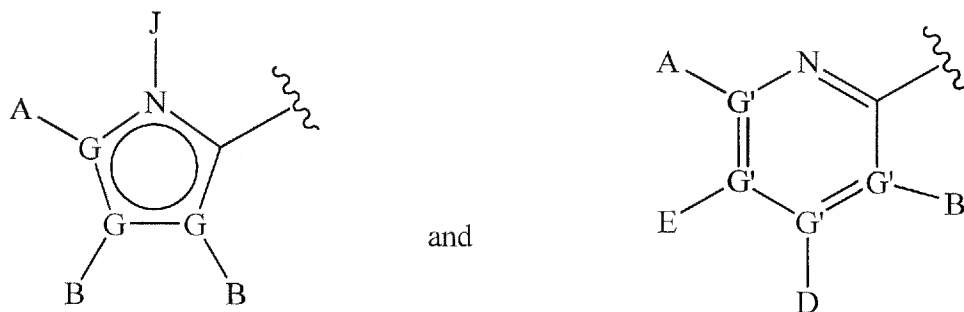
$R^{15}$  is selected from the group consisting of -H, lower alkyl, lower aryl, lower aralkyl, or together with  $R^{16}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

$R^{16}$  is selected from the group consisting of  $-(CR^{12}R^{13})_n-C(O)-R^{14}$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{15}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

each  $R^{17}$  is independently selected from the group consisting of lower alkyl, lower aryl, and lower aralkyl, or together  $R^{17}$  and  $R^{17}$  on N is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

with the proviso that when only one Y is -O-, and it is not part of a cyclic group containing the other Y, then the other Y must be  $-N(R^{18})-(CR^{12}R^{13})-C(O)-R^{14}$ .

158 (new). The method of claim 157 wherein M is  $R^5$ -X- wherein  $R^5$  is selected from the group consisting of:



wherein:

each G is independently selected from the group consisting of C, N, O, S, and Se, and wherein only one G may be O, S, or Se, and at most one G is N;

each G' is independently selected from the group consisting of C and N and wherein no more than two G' groups are N;

A is selected from the group consisting of -H,  $-NR^4_2$ ,  $-CONR^4_2$ ,  $-CO_2R^3$ , halo,  $-S(O)R^3$ ,  $-SO_2R^3$ , alkyl, alkenyl, alkynyl, perhaloalkyl, haloalkyl, aryl,  $-CH_2OH$ ,  $-CH_2NR^4_2$ ,  $-CH_2CN$ ,  $-CN$ ,  $-C(S)NH_2$ ,  $-OR^3$ ,  $-SR^3$ ,  $-N_3$ ,  $-NHC(S)NR^4_2$ ,  $-NHAc$ , and null;

each B and D are independently selected from the group consisting of -H, alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, alkoxyalkyl,  $-C(O)R^{11}$ ,  $-C(O)SR^3$ ,  $-SO_2R^{11}$ ,  $-S(O)R^3$ ,  $-CN$ ,  $-NR^9_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo,  $-NO_2$ , and null, all except -H,  $-CN$ , perhaloalkyl,  $-NO_2$ , and halo are optionally substituted;

E is selected from the group consisting of -H, alkyl, alkenyl, alkynyl, aryl, alicyclic, alkoxyalkyl,  $-C(O)OR^3$ ,  $-CONR^4_2$ ,  $-CN$ ,  $-NR^9_2$ ,  $-NO_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo, and null, all except -H,  $-CN$ , perhaloalkyl, and halo are optionally substituted;

J is selected from the group consisting of -H and null;

X is optionally substituted linking group that links  $R^5$  to the phosphorus atom via 2-4 atoms, including 0-1 heteroatoms selected from N, O, and S, except that if X is urea or carbamate there are 2 heteroatoms, measured by the shortest path between  $R^5$  and the phosphorus atom, and wherein the atom attached to the phosphorus is a carbon atom,



and wherein X is selected from the group consisting of -alkyl(hydroxy)-, -alkynyl-, -heteroaryl-, -carbonylalkyl-, -1,1-dihaloalkyl-, -alkoxyalkyl-, alkyloxy-, -alkylthioalkyl-, -alkylthio-, alkylaminocarbonyl-, alkylcarbonylamino-, -alkoxycarbonyl-, -carbonyloxyalkyl-, -alkoxycarbonylamino-, and -alkylaminocarbonylamino-, all optionally substituted; with the proviso that X is not substituted with  $-\text{COOR}^2$ ,  $-\text{SO}_3\text{H}$ , or  $-\text{PO}_3\text{R}^2_2$ ;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and  $-\text{H}$ ;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of  $-\text{H}$ , and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

each  $\text{R}^9$  is independently selected from the group consisting of  $-\text{H}$ , alkyl, aralkyl, and alicyclic, or together  $\text{R}^9$  and  $\text{R}^9$  form a cyclic alkyl group;

$\text{R}^{11}$  is selected from the group consisting of alkyl, aryl,  $-\text{NR}^2_2$ , and  $-\text{OR}^2$ ;

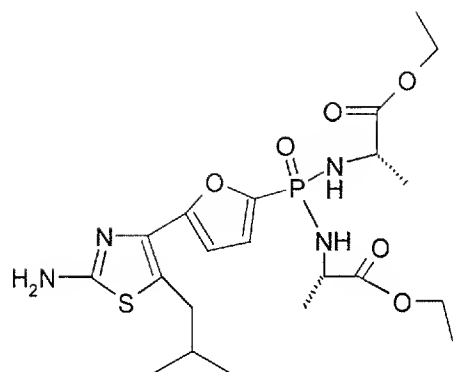
and with the proviso that:

- 1) when  $\text{G}'$  is N, then the respective A, B, D, or E is null;
- 2) at least one of A and B, or A, B, D, and E is not selected from the group consisting of  $-\text{H}$  or null;
- 3) when  $\text{R}^5$  is a six-membered ring, then X is not any 2 atom linker, an optionally substituted -alkyloxy-, or an optionally substituted -alkylthio-;
- 4) when G is N, then the respective A or B is not halogen or a group directly bonded to G via a heteroatom;
- 5) when X is not a -heteroaryl- group, then  $\text{R}^5$  is not substituted with two or more aryl groups;

and pharmaceutically acceptable prodrugs and salts thereof.

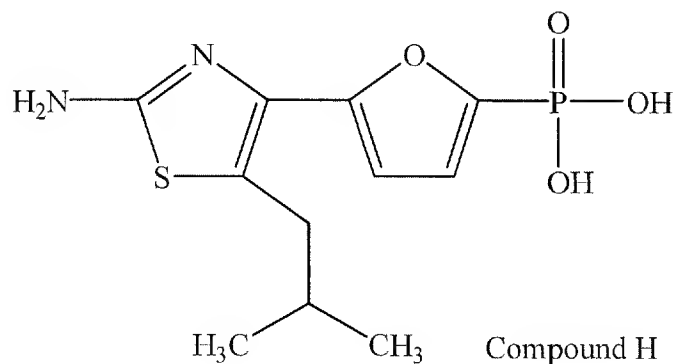
159 (new). The method of claim 143 wherein said insulin sensitizer is a thiazolidinedione.

160 (new). The method of claim 144 wherein said FBPase inhibitor is



Compound J

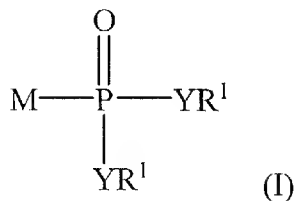
or



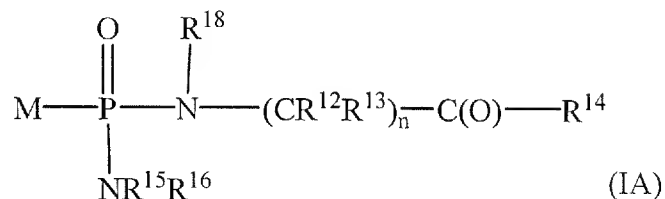
Compound H

and said insulin sensitizer is troglitazone.

161 (new). The method of claim 144 wherein said FB Pase inhibitor is a compound selected from the group consisting of formulae I and IA:



and



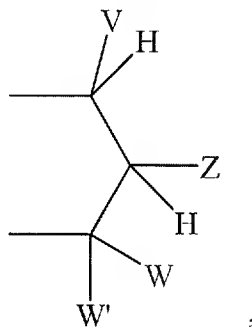
wherein *in vivo* or *in vitro* compounds of formulae I and IA are converted to  $\text{M-PO}_3^{2-}$  which inhibits FB Pase and wherein

Y is independently selected from the group consisting of -O-, and -NR<sup>6</sup>-;

when Y is -O-, then R<sup>1</sup> attached to -O- is independently selected from the group consisting of -H, alkyl, optionally substituted aryl, optionally substituted alicyclic where the cyclic moiety contains a carbonate or thiocarbonate, optionally substituted -alkylaryl, -C(R<sup>2</sup>)<sub>2</sub>OC(O)NR<sup>2</sup><sub>2</sub>, -NR<sup>2</sup>-C(O)-R<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>-OC(O)R<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>-O-C(O)OR<sup>3</sup>, -C(R<sup>2</sup>)<sub>2</sub>OC(O)SR<sup>3</sup>, -alkyl-S-C(O)R<sup>3</sup>, -alkyl-S-S-alkylhydroxy, and -alkyl-S-S-S-alkylhydroxy,

when Y is -NR<sup>6</sup>-, then R<sup>1</sup> attached to -NR<sup>6</sup>- is independently selected from the group consisting of -H, -[C(R<sup>2</sup>)<sub>2</sub>]<sub>q</sub>-COOR<sup>3</sup>, -C(R<sup>4</sup>)<sub>2</sub>COOR<sup>3</sup>, -[C(R<sup>2</sup>)<sub>2</sub>]<sub>q</sub>-C(O)SR, and -cycloalkylene-COOR<sup>3</sup>;

or when either Y is independently selected from -O- and -NR<sup>6</sup>-, then together R<sup>1</sup> and R<sup>1</sup> are -alkyl-S-S-alkyl- to form a cyclic group, or together R<sup>1</sup> and R<sup>1</sup> are



wherein:

V, W, and W' are independently selected from the group consisting of -H, alkyl, aralkyl, alicyclic, aryl, substituted aryl, heteroaryl, substituted heteroaryl, 1-alkenyl, and 1-alkynyl; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group containing 5-7 atoms, optionally 1 heteroatom, substituted with hydroxy, acyloxy, alkoxy, alkoxy, alkoxy, or aryloxy, attached to a carbon atom that is three atoms from both Y groups attached to the phosphorus; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group, optionally containing 1 heteroatom, that is fused to an aryl group at the beta and gamma position to the Y attached to the phosphorus;

together V and W are connected via an additional 3 carbon atoms to form an optionally substituted cyclic group containing 6 carbon atoms and substituted with one substituent selected from the group consisting of hydroxy, acyloxy, alkoxy, alkoxy, alkoxy, alkylthiocarbonyloxy, and

aryloxycarbonyloxy, attached to one of said carbon atoms that is three atoms from a Y attached to the phosphorus;

together Z and W are connected via an additional 3-5 atoms to form a cyclic group, optionally containing one heteroatom, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

together W and W' are connected via an additional 2-5 atoms to form a cyclic group, optionally containing 0-2 heteroatoms, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

Z is selected from the group consisting of  $-\text{CHR}^2\text{OH}$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{OR}^3$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{SR}^3$ ,  $-\text{CHR}^2\text{OCO}_2\text{R}^3$ ,  $-\text{OR}^2$ ,  $-\text{SR}^2$ ,  $-\text{CHR}^2\text{N}_3$ ,  $-\text{CH}_2\text{aryl}$ ,  $-\text{CH}(\text{aryl})\text{OH}$ ,  $-\text{CH}(\text{CH}=\text{CR}^2_2)\text{OH}$ ,  $-\text{CH}(\text{C}\equiv\text{CR}^2)\text{OH}$ ,  $-\text{R}^2$ ,  $-\text{NR}^2_2$ ,  $-\text{OCOR}^3$ ,  $-\text{OCO}_2\text{R}^3$ ,  $-\text{SCOR}^3$ ,  $-\text{SCO}_2\text{R}^3$ ,  $-\text{NHCOR}^2$ ,  $-\text{NHCO}_2\text{R}^3$ ,  $-\text{CH}_2\text{NHaryl}$ ,  $-(\text{CH}_2)_p-\text{OR}^2$ , and  $-(\text{CH}_2)_p-\text{SR}^2$ ;

p is an integer 2 or 3;

q is an integer 1 or 2;

with the provisos that:

- a) V, Z, W, W' are not all -H; and
- b) when Z is  $-\text{R}^2$ , then at least one of V, W, and W' is not -H, alkyl, aralkyl, or alicyclic;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and -H;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of -H, and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

$\text{R}^6$  is selected from the group consisting of -H, lower alkyl, acyloxyalkyl, alkoxy carbonyloxyalkyl, and lower acyl;

n is an integer from 1 to 3;

$\text{R}^{18}$  is independently selected from the group consisting of H, lower alkyl, aryl, aralkyl, or together with  $\text{R}^{12}$  is connected via 1-4 carbon atoms to form a cyclic group;

each  $\text{R}^{12}$  and  $\text{R}^{13}$  is independently selected from the group consisting of H, lower alkyl, lower aryl, lower aralkyl, all optionally substituted, or  $\text{R}^{12}$  and  $\text{R}^{13}$  together are connected via 2-6 carbon atoms to form a cyclic group;

each  $R^{14}$  is independently selected from the group consisting of  $-OR^{17}$ ,  $-N(R^{17})_2$ ,  $-NHR^{17}$ , and  $-SR^{17}$ ;

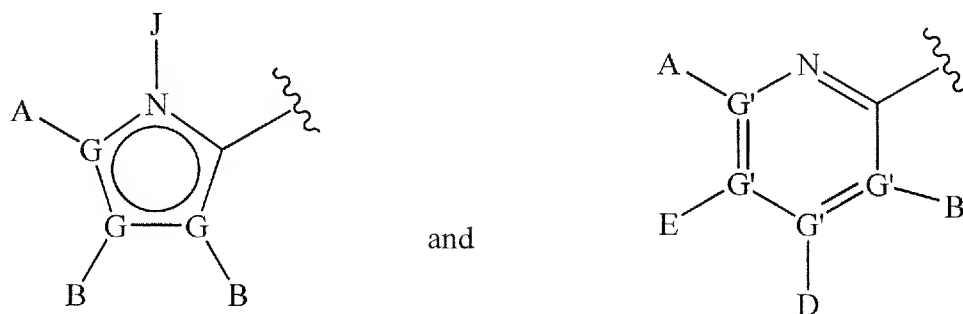
$R^{15}$  is selected from the group consisting of  $-H$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{16}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

$R^{16}$  is selected from the group consisting of  $-(CR^{12}R^{13})_n-C(O)-R^{14}$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{15}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

each  $R^{17}$  is independently selected from the group consisting of lower alkyl, lower aryl, and lower aralkyl, or together  $R^{17}$  and  $R^{17}$  on N is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

with the proviso that when only one Y is  $-O-$ , and it is not part of a cyclic group containing the other Y, then the other Y must be  $-N(R^{18})-(CR^{12}R^{13})-C(O)-R^{14}$ .

162 (new). The method of claim 161 wherein M is  $R^5-X$ - wherein  $R^5$  is selected from the group consisting of:



wherein:

each G is independently selected from the group consisting of C, N, O, S, and Se, and wherein only one G may be O, S, or Se, and at most one G is N;

each G' is independently selected from the group consisting of C and N and wherein no more than two G' groups are N;

A is selected from the group consisting of  $-H$ ,  $-NR^4_2$ ,  $-CONR^4_2$ ,  $-CO_2R^3$ , halo,  $-S(O)R^3$ ,  $-SO_2R^3$ , alkyl, alkenyl, alkynyl, perhaloalkyl, haloalkyl, aryl,  $-CH_2OH$ ,  $-CH_2NR^4_2$ ,  $-CH_2CN$ ,  $-CN$ ,  $-C(S)NH_2$ ,  $-OR^3$ ,  $-SR^3$ ,  $-N_3$ ,  $-NHC(S)NR^4_2$ ,  $-NHAc$ , and null;

each B and D are independently selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, alkoxyalkyl,  $-C(O)R^{11}$ ,  $-C(O)SR^3$ ,  $-SO_2R^{11}$ ,  $-S(O)R^3$ ,  $-CN$ ,  $-NR^9_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo,  $-NO_2$ , and null, all except  $-H$ ,  $-CN$ , perhaloalkyl,  $-NO_2$ , and halo are optionally substituted;

E is selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, alkoxyalkyl,  $-C(O)OR^3$ ,  $-CONR^4_2$ ,  $-CN$ ,  $-NR^9_2$ ,  $-NO_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo, and null, all except  $-H$ ,  $-CN$ , perhaloalkyl, and halo are optionally substituted;

J is selected from the group consisting of  $-H$  and null;

X is optionally substituted linking group that links  $R^5$  to the phosphorus atom via 2-4 atoms, including 0-1 heteroatoms selected from N, O, and S, except that if X is urea or carbamate there are 2 heteroatoms, measured by the shortest path between  $R^5$  and the phosphorus atom, and wherein the atom attached to the phosphorus is a carbon atom,

and wherein X is selected from the group consisting of  $-alkyl(hydroxy)-$ ,  $-alkynyl-$ ,  $-heteroaryl-$ ,  $-carbonylalkyl-$ ,  $-1,1-dihaloalkyl-$ ,  $-alkoxyalkyl-$ ,  $alkyloxy-$ ,  $-alkylthioalkyl-$ ,  $-alkylthio-$ ,  $alkylaminocarbonyl-$ ,  $alkylcarbonylamino-$ ,  $-alkoxycarbonyl-$ ,  $-carbonyloxyalkyl-$ ,  $-alkoxycarbonylamino-$ , and  $-alkylaminocarbonylamino-$ , all optionally substituted; with the proviso that X is not substituted with  $-COOR^2$ ,  $-SO_3H$ , or  $-PO_3R^2_2$ ;

$R^2$  is selected from the group consisting of  $R^3$  and  $-H$ ;

$R^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $R^4$  is independently selected from the group consisting of  $-H$ , and alkyl, or together  $R^4$  and  $R^4$  form a cyclic alkyl group;

each  $R^9$  is independently selected from the group consisting of  $-H$ , alkyl, aralkyl, and alicyclic, or together  $R^9$  and  $R^9$  form a cyclic alkyl group;

$R^{11}$  is selected from the group consisting of alkyl, aryl,  $-NR^2_2$ , and  $-OR^2$ ;

and with the proviso that:

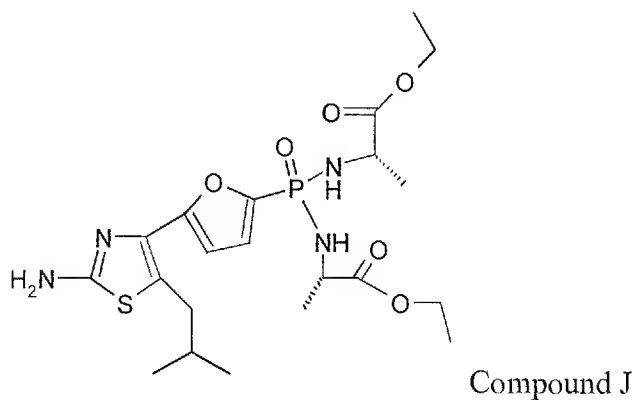
1) when  $G'$  is N, then the respective A, B, D, or E is null;

- 2) at least one of A and B, or A, B, D, and E is not selected from the group consisting of –H or null;
- 3) when R<sup>5</sup> is a six-membered ring, then X is not any 2 atom linker, an optionally substituted –alkyloxy-, or an optionally substituted –alkylthio-;
- 4) when G is N, then the respective A or B is not halogen or a group directly bonded to G via a heteroatom;
- 5) when X is not a –heteroaryl- group, then R<sup>5</sup> is not substituted with two or more aryl groups;

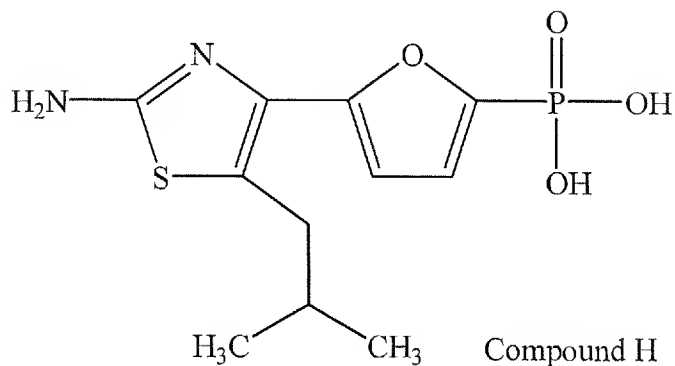
and pharmaceutically acceptable prodrugs and salts thereof.

163 (new). The method of claim 144 wherein said insulin sensitizer is a thiazolidinedione.

164 (new). The method of claim 146 wherein said FBPase inhibitor is

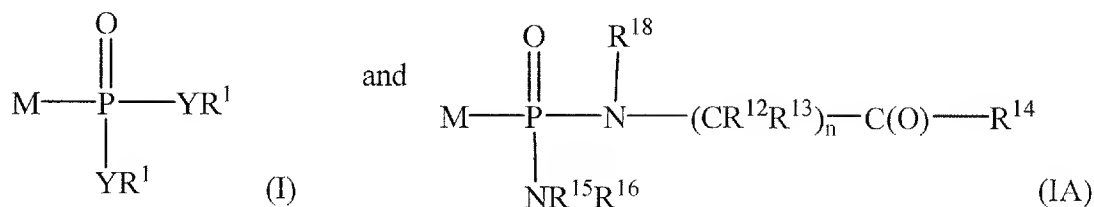


or



and said insulin sensitizer is troglitazone.

165 (new). The method of claim 146 wherein said FBPase inhibitor is a compound selected from the group consisting of formulae I and IA:



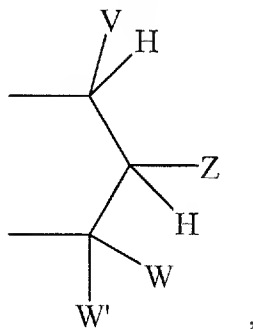
wherein *in vivo* or *in vitro* compounds of formulae I and IA are converted to  $\text{M-PO}_3^{2-}$  which inhibits FBPase and wherein

Y is independently selected from the group consisting of -O-, and  $-\text{NR}^6$ ;

when Y is -O-, then  $\text{R}^1$  attached to -O- is independently selected from the group consisting of -H, alkyl, optionally substituted aryl, optionally substituted alicyclic where the cyclic moiety contains a carbonate or thiocarbonate, optionally substituted -alkylaryl,  $-\text{C}(\text{R}^2)_2\text{OC}(\text{O})\text{NR}^2_2$ ,  $-\text{NR}^2-\text{C}(\text{O})-\text{R}^3$ ,  $-\text{C}(\text{R}^2)_2-\text{OC}(\text{O})\text{R}^3$ ,  $-\text{C}(\text{R}^2)_2-\text{O}-\text{C}(\text{O})\text{OR}^3$ ,  $-\text{C}(\text{R}^2)_2\text{OC}(\text{O})\text{SR}^3$ , -alkyl-S-C(O)R<sup>3</sup>, -alkyl-S-S-alkylhydroxy, and -alkyl-S-S-S-alkylhydroxy,

when Y is  $-\text{NR}^6$ -, then  $\text{R}^1$  attached to  $-\text{NR}^6$ - is independently selected from the group consisting of -H,  $-\text{[C}(\text{R}^2)_2\text{]}_q\text{-COOR}^3$ ,  $-\text{C}(\text{R}^4)_2\text{COOR}^3$ ,  $-\text{[C}(\text{R}^2)_2\text{]}_q\text{-C}(\text{O})\text{SR}$ , and -cycloalkylene-COOR<sup>3</sup>;

or when either Y is independently selected from -O- and  $-\text{NR}^6$ -, then together  $\text{R}^1$  and  $\text{R}^1$  are -alkyl-S-S-alkyl- to form a cyclic group, or together  $\text{R}^1$  and  $\text{R}^1$  are



wherein:



V, W, and W' are independently selected from the group consisting of -H, alkyl, aralkyl, alicyclic, aryl, substituted aryl, heteroaryl, substituted heteroaryl, 1-alkenyl, and 1-alkynyl; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group containing 5-7 atoms, optionally 1 heteroatom, substituted with hydroxy, acyloxy, alkoxycarbonyloxy, or aryloxycarbonyloxy attached to a carbon atom that is three atoms from both Y groups attached to the phosphorus; or

together V and Z are connected via an additional 3-5 atoms to form a cyclic group, optionally containing 1 heteroatom, that is fused to an aryl group at the beta and gamma position to the Y attached to the phosphorus;

together V and W are connected via an additional 3 carbon atoms to form an optionally substituted cyclic group containing 6 carbon atoms and substituted with one substituent selected from the group consisting of hydroxy, acyloxy, alkoxycarbonyloxy, alkylthiocarbonyloxy, and aryloxycarbonyloxy, attached to one of said carbon atoms that is three atoms from a Y attached to the phosphorus;

together Z and W are connected via an additional 3-5 atoms to form a cyclic group, optionally containing one heteroatom, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

together W and W' are connected via an additional 2-5 atoms to form a cyclic group, optionally containing 0-2 heteroatoms, and V must be aryl, substituted aryl, heteroaryl, or substituted heteroaryl;

Z is selected from the group consisting of  $-\text{CHR}^2\text{OH}$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{R}^3$ ,  $-\text{CHR}^2\text{OC}(\text{S})\text{OR}^3$ ,  $-\text{CHR}^2\text{OC}(\text{O})\text{SR}^3$ ,  $-\text{CHR}^2\text{OCO}_2\text{R}^3$ ,  $-\text{OR}^2$ ,  $-\text{SR}^2$ ,  $-\text{CHR}^2\text{N}_3$ ,  $-\text{CH}_2\text{aryl}$ ,  $-\text{CH}(\text{aryl})\text{OH}$ ,  $-\text{CH}(\text{CH}=\text{CR}^2_2)\text{OH}$ ,  $-\text{CH}(\text{C}\equiv\text{CR}^2)\text{OH}$ ,  $-\text{R}^2$ ,  $-\text{NR}^2_2$ ,  $-\text{OCOR}^3$ ,  $-\text{OCO}_2\text{R}^3$ ,  $-\text{SCOR}^3$ ,  $-\text{SCO}_2\text{R}^3$ ,  $-\text{NHCOR}^2$ ,  $-\text{NHCO}_2\text{R}^3$ ,  $-\text{CH}_2\text{NHaryl}$ ,  $-(\text{CH}_2)_p-\text{OR}^2$ , and  $-(\text{CH}_2)_p-\text{SR}^2$ ;

p is an integer 2 or 3;

q is an integer 1 or 2;

with the provisos that:

- a) V, Z, W, W' are not all -H; and
- b) when Z is  $-\text{R}^2$ , then at least one of V, W, and W' is not -H, alkyl, aralkyl, or alicyclic;

$R^2$  is selected from the group consisting of  $R^3$  and -H;

$R^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $R^4$  is independently selected from the group consisting of -H, and alkyl, or together  $R^4$  and  $R^4$  form a cyclic alkyl group;

$R^6$  is selected from the group consisting of -H, lower alkyl, acyloxyalkyl, alkoxycarbonyloxyalkyl, and lower acyl;

n is an integer from 1 to 3;

$R^{18}$  is independently selected from the group consisting of H, lower alkyl, aryl, aralkyl, or together with  $R^{12}$  is connected via 1-4 carbon atoms to form a cyclic group;

each  $R^{12}$  and  $R^{13}$  is independently selected from the group consisting of H, lower alkyl, lower aryl, lower aralkyl, all optionally substituted, or  $R^{12}$  and  $R^{13}$  together are connected via 2-6 carbon atoms to form a cyclic group;

each  $R^{14}$  is independently selected from the group consisting of  $-OR^{17}$ ,  $-N(R^{17})_2$ ,  $-NHR^{17}$ , and  $-SR^{17}$ ;

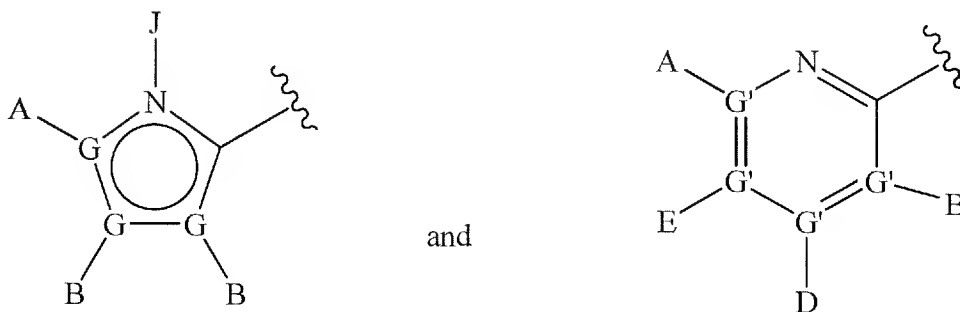
$R^{15}$  is selected from the group consisting of -H, lower alkyl, lower aryl, lower aralkyl, or together with  $R^{16}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

$R^{16}$  is selected from the group consisting of  $-(CR^{12}R^{13})_n-C(O)-R^{14}$ , lower alkyl, lower aryl, lower aralkyl, or together with  $R^{15}$  is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

each  $R^{17}$  is independently selected from the group consisting of lower alkyl, lower aryl, and lower aralkyl, or together  $R^{17}$  and  $R^{17}$  on N is connected via 2-6 atoms, optionally including 1 heteroatom selected from the group consisting of O, N, and S;

with the proviso that when only one Y is -O-, and it is not part of a cyclic group containing the other Y, then the other Y must be  $-N(R^{18})-(CR^{12}R^{13})-C(O)-R^{14}$ .

166 (new). The method of claim 165 wherein M is  $R^5$ -X- wherein  $R^5$  is selected from the group consisting of:



wherein:

each G is independently selected from the group consisting of C, N, O, S, and Se, and wherein only one G may be O, S, or Se, and at most one G is N;

each G' is independently selected from the group consisting of C and N and wherein no more than two G' groups are N;

A is selected from the group consisting of  $-H$ ,  $-NR^4_2$ ,  $-CONR^4_2$ ,  $-CO_2R^3$ , halo,  $-S(O)R^3$ ,  $-SO_2R^3$ , alkyl, alkenyl, alkynyl, perhaloalkyl, haloalkyl, aryl,  $-CH_2OH$ ,  $-CH_2NR^4_2$ ,  $-CH_2CN$ ,  $-CN$ ,  $-C(S)NH_2$ ,  $-OR^3$ ,  $-SR^3$ ,  $-N_3$ ,  $-NHC(S)NR^4_2$ ,  $-NHAc$ , and null;

each B and D are independently selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, aralkyl, alkoxyalkyl,  $-C(O)R^{11}$ ,  $-C(O)SR^3$ ,  $-SO_2R^{11}$ ,  $-S(O)R^3$ ,  $-CN$ ,  $-NR^9_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo,  $-NO_2$ , and null, all except  $-H$ ,  $-CN$ , perhaloalkyl,  $-NO_2$ , and halo are optionally substituted;

E is selected from the group consisting of  $-H$ , alkyl, alkenyl, alkynyl, aryl, alicyclic, alkoxyalkyl,  $-C(O)OR^3$ ,  $-CONR^4_2$ ,  $-CN$ ,  $-NR^9_2$ ,  $-NO_2$ ,  $-OR^3$ ,  $-SR^3$ , perhaloalkyl, halo, and null, all except  $-H$ ,  $-CN$ , perhaloalkyl, and halo are optionally substituted;

J is selected from the group consisting of  $-H$  and null;

X is optionally substituted linking group that links  $R^5$  to the phosphorus atom via 2-4 atoms, including 0-1 heteroatoms selected from N, O, and S, except that if X is urea or carbamate there are 2 heteroatoms, measured by the shortest path between  $R^5$  and the phosphorus atom, and wherein the atom attached to the phosphorus is a carbon atom,

and wherein X is selected from the group consisting of -alkyl(hydroxy)-, -alkynyl-, -heteroaryl-, -carbonylalkyl-, -1,1-dihaloalkyl-, -alkoxyalkyl-, alkyloxy-, -alkylthioalkyl-, -alkylthio-, alkylaminocarbonyl-, alkylcarbonylamino-, -alkoxycarbonyl-, -carbonyloxyalkyl-, -alkoxycarbonylamino-, and -alkylaminocarbonylamino-, all optionally substituted; with the proviso that X is not substituted with  $-\text{COOR}^2$ ,  $-\text{SO}_3\text{H}$ , or  $-\text{PO}_3\text{R}^2$ ;

$\text{R}^2$  is selected from the group consisting of  $\text{R}^3$  and  $-\text{H}$ ;

$\text{R}^3$  is selected from the group consisting of alkyl, aryl, alicyclic, and aralkyl;

each  $\text{R}^4$  is independently selected from the group consisting of  $-\text{H}$ , and alkyl, or together  $\text{R}^4$  and  $\text{R}^4$  form a cyclic alkyl group;

each  $\text{R}^9$  is independently selected from the group consisting of  $-\text{H}$ , alkyl, aralkyl, and alicyclic, or together  $\text{R}^9$  and  $\text{R}^9$  form a cyclic alkyl group;

$\text{R}^{11}$  is selected from the group consisting of alkyl, aryl,  $-\text{NR}^2$ , and  $-\text{OR}^2$ ;

and with the proviso that:

- 1) when  $\text{G}'$  is N, then the respective A, B, D, or E is null;
- 2) at least one of A and B, or A, B, D, and E is not selected from the group consisting of  $-\text{H}$  or null;
- 3) when  $\text{R}^5$  is a six-membered ring, then X is not any 2 atom linker, an optionally substituted -alkyloxy-, or an optionally substituted -alkylthio-;
- 4) when G is N, then the respective A or B is not halogen or a group directly bonded to G via a heteroatom;
- 5) when X is not a -heteroaryl- group, then  $\text{R}^5$  is not substituted with two or more aryl groups;

and pharmaceutically acceptable prodrugs and salts thereof.

167 (new). The method of claim 146 wherein said insulin sensitizer is a thiazolidinedione.